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FRIDAY, JANUARY 25, 1901.

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*THE ORIGIN, SCOPE AND SIGNIFICANCE OF BACTERIOLOGY.**

BACTERIOLOGY is a child of the 19th century. It is the offspring of chemistry and biology, enriched by physics with the gift of the achromatic microscope.

By the end of the first quarter of the century, natural philosophy, natural history and chemistry had almost wholly displaced the magic and alchemy of the Middle Ages and the Renaissance. Natural law was the explanation indicated by natural knowledge for natural phenomena, and in most cases a natural explanation of these phenomena was either discoverable or conceivable. The Copernican theory, as developed by Galileo, Kepler, Newton and their successors, accounted satisfactorily for the obvious structure and operation of the solar system. The researches of Vesalius and Harvey, and their successors, had made comprehensible the anatomy and physiology of the animal body. The earth, in response to the inquiries of Hutton and Lyell, was yielding up the record of its slow but sublime history, its very rocks bearing eloquent testimony to their natural origin. The lightning of heaven, the thunderbolt of Zeus, interrogated by our own Franklin, had confessed its affinity

* Address delivered by the president before the Society of American Bacteriologists, Baltimore, December 27, 1900.

to the humbler electricity of glass and amber. Everywhere the growth of natural knowledge revealed always more and more of natural law. Magic and mystery in the greater part of the macrocosm and microcosm were no more. Alchemy, the philosophers' stone and the transmutation of metals were gone forever. Yet even as late as 1835 there still remained one large group of familiar natural phenomena which was neither understood nor explained.

Fermentation, and especially alcoholic fermentation, had long excited the wonder of the ignorant, the curiosity of the wise. Fermentation was obviously the seat of active, spontaneous, self-regulated change. Its bubbling had given to it the name, which comes from the Latin *fervere*, to boil. Yeast was the constant accompaniment of the alcoholic fermentation, but exactly what yeast was no one knew. At best it seemed to be a consequence rather than a cause of fermentation, since it was more abundant at the end than at the beginning, more abundant in the later and less active stages than in the earlier and more active. Leeuwenhoeck indeed had examined yeast microscopically and found in it what seemed to be living cells, but his discovery appears to have occasioned no great surprise and to have been virtually forgotten after the lapse of a hundred and fifty years. The bubbling or boiling of the alcoholic fermentation suggested the action of acid on limestone, but as there was no limestone present and very little acid the suggestion explained nothing and was not very helpful. Chemistry had dealt with the alcoholic fermentation, and had come to the conclusion, based upon analyses and experiments, that it was a purely chemical process, in which sugar was decomposed wholly into alcohol and carbonic acid, the cause of the decomposition being the aggressive action of the oxygen of the air.

These were the days in which oxygen was much in fashion, for it had been only recently discovered by Priestley in 1774, and it was perhaps natural that Gay Lussac, reflecting upon the successful experiments by Appert in preserving foods by canning, should have concluded that it was the exclusion of the atmospheric oxygen from the tins which prevented fermentation of the fruit juices which they contained. He was confirmed in this opinion by his own experiment upon grape juice in the Torricellian vacuum, and his theory was, naturally enough, accepted and extended by his pupil Liebig. There were not wanting, however, objectors to this theory, nor experiments which seemed to disprove it, and it was never very satisfactory because it failed to account adequately, not only for the constant presence and growth of yeast—for which no provision was made in Gay Lussac's formula, —but also because of the total absence of oxygen in the most active stages of alcoholic fermentation as conducted in breweries, etc. For most persons, therefore, fermentation was still an unsolved problem when, in 1836, Schulze completely disproved the oxygen theory by showing that ordinary air, such as had been excluded in the experiments of Appert and Gay Lussac, was unable, even if admitted, to produce fermentation if it had first been caused to bubble slowly through concentrated sulphuric acid which, whatever else it might do, certainly could not deprive it of oxygen.

Putrefaction was another unsolved problem in nature, not only at the beginning of this century, but as late as 1835. It obviously resembled fermentation in some respects, and had often been classified with it, but yet it was also obviously different. Bubbling was not always an accompaniment of it, and the microscopes of the day, comparatively poor as they were, had revealed the almost constant presence in putrefactions of swarms of microscopic

forms of life roughly classified as 'animalcules.' These were either not present at all in the alcoholic fermentation or, if present, were few in number. Moreover, in this case also, the microscopic life seemed to be a consequence rather than a cause of putrefaction, inasmuch as it was most abundant, not at the beginning, but toward the end of the process. Meat kept in warm air or warm water soon 'spoiled,' though exactly how or why no one knew. Chemical changes were obvious and abundant, but of a totally different kind from those characterizing the fermentation of alcohol or vinegar.

Organic decomposition and decay, two of the most widespread and universal processes in nature, while occurring on every hand, were in the early part of our century either not understood or else incorrectly interpreted. The slow decay of timber and of teeth, the rapid decay of fruits and flowers, sometimes, it is true, suggested putrefactions, but quite as often went on almost insidiously and unobserved. Even after the first quarter of our century had gone by, slow decay was given a very large name, *eremacausis*, but yet was only imperfectly understood. The current explanation, such as it was, was in harmony with the few facts established by chemistry, viz., a theory of oxidation probably produced by the aggressive energy of free oxygen. Iron rusted readily enough; why should not wood and teeth and fruits 'rust' also in a somewhat different, but still essentially similar, way. This hypothesis seemed to be confirmed by the fact that canned fruits and foods were preserved so long as air was excluded from them, but spoiled soon after being exposed to the atmosphere. It was not observed, or if observed it was forgotten or believed to be immaterial, that meat and fish and fruits could be equally well preserved for an indefinite length of time by simple drying, although remaining constantly exposed in the dry condition to the aggressive action of the free oxygen of the air.

Nitrification, or the conversion of nitrogenous organic matter into mineral nitrates, was well known in the early part of our century as one of the most fundamental processes in nature and of prime importance in agriculture; manures, for example, being nitrified before they could become fit food for green plants. Precisely how this nitrification was effected, however, was not known, although it was suggested that free oxygen somehow oxidized organic nitrogen by a process similar to that in which it attacks iron. Obviously, this process went on best, if not exclusively, in the soil, for organic nitrogen elsewhere showed little or no tendency to unite with oxygen to form nitrates. The soil seemed to have some peculiar property of favoring this oxidation, but exactly what this property could be, unless it were a kind of platinum-sponge effect, was by no means clear even to the most eminent chemists and naturalists.

Natural 'heating' and 'sweating' were processes familiar enough to all observers of natural phenomena, but exactly what they meant no one in the early part of our century knew. Hay, imperfectly cured, heated and even rotted in the barn. Manure, collected in heaps, underwent a spontaneous and peculiar change by which it was altered or ripened, sometimes becoming intensely hot and giving off vapors which indicated profound and important chemical changes. Flax, in the course of the preparation of linen fiber, was made to undergo a peculiar maceration or change which must have suggested fermentation or decay and was known as rotting or 'retting.' Hides, in the peculiar and primitive processes preliminary to tanning, often underwent a similar change known as 'drenching.' Tobacco 'sweated,' and milk 'soured,' spontaneously. Cider 'turned' into vinegar, grape-juice into wine, and in various other domestic or indus-

trial processes advantage was taken of 'spontaneous' changes of highly peculiar and unexplained characteristics.

Contemporary spontaneous generation, in the first half of our century, was commonly accepted as a fact even by many scientific men, who held that it was the simplest explanation of the origin of the swarms of microscopic organisms observed in putrefying liquids or infusion. The belief in easy and constant spontaneous generation of living from lifeless matter is probably as old as the human race, and if we bear in mind the ignorance which was universal concerning the nature and complexity of even the simplest forms of life, and the complete lack of trustworthy evidence such as we have to-day against the theory of present-day abiogenesis, we can not wonder that this theory should have been so recently and so widely held. It is true that some of the most acute observers, such as Leeuwenhoek, had utterly refused to accept the theory, arguing that the total absence of abiogenesis in the higher forms of life made its occurrence in the lowest forms highly improbable, but we must admit that in these cases their conclusions were based rather upon instinct than scientific evidence. Granting, as we must, the theoretical possibility, and perhaps probability, of this process in the primordial origin of life upon our globe, we may well be slow to condemn those who leaned toward the theory of modern spontaneous generation as the most reasonable explanation of the myriad life of to-day in the under microscopic world. At the same time it can hardly be doubted that the belief in present-day spontaneous generation represented the last survival of such traces of belief in magic, alchemy, and the transmutation of metals, as the nineteenth century inherited from its predecessors.

In the early part of our century there was a group of natural phenomena of a different order, which, though painfully familiar, was equally puzzling and mysterious. Seemingly spontaneous in origin, always inexplicable, erratic and mysterious in transmission, often swift in operation and fatally destructive to human life, the mysterious phenomena known as *epidemics, plagues and pestilences* were among the most dreaded of all natural occurrences. Many indeed still spoke of them as 'visitations of the Almighty,' and treated them as if they were of superhuman origin, but Dr. William Farr, in preparing a classification of diseases for the purposes of the registration of vital statistics—made for the first time in history on a large scale in England in 1839—recorded epidemics, plagues and pestilences as strictly natural phenomena, though obscure, and while specifically denying any intention of considering them as fermentations, almost unconsciously acknowledged their affinity to fermentations by the name which he applied to them, and under which they have ever since been known, viz., the 'zymotic' or fermentative diseases. Dr. Farr gives no theory of their origin or causation and expressly declines to regard them as fermentations, partly, no doubt, because of the vehemence of Liebig, who was opposed to the idea, but also, we may believe, because the prevailing theory of the cause of fermentation was that it was due to the aggressive energy of free oxygen; and it would have been obviously too absurd to assert that free oxygen, the very breath of human life, is at the same time the cause of its worst diseases. In Germany, Henle arrived, largely from observation and *a priori* reasoning, at a conclusion essentially similar to Dr. Farr's, and, in America, Professor J. K. Mitchell, father of our distinguished physiologist and litterateur, Dr. Weir Mitchell, was urging, upon similar grounds, his able thesis 'On the Cryptogamous Origin of Malarious and Epidemic Fevers.'

To recapitulate.—While, in the first half of our century, the anatomy and physiology of the macrocosm and the microcosm, the heavens, the earth and man, were fairly well understood, there yet remained certain important natural phenomena either generally not understood at all or else, as we know, almost completely misinterpreted, namely, as follows:

1. Fermentation of every kind.
2. Putrefactions.
3. Organic decomposition and decay.
4. Nitrification.
5. The origin of microscopic life.
6. Zymotic diseases.

The end of the third decade of our century saw the beginning of a profound change in the accepted theories concerning all or nearly all of these phenomena. In 1836, Schulze proved that the oxygen theory of fermentation could not be correct. The next year Theodor Schwann confirmed his results by a different experiment, and by the improved achromatic microscope not only discovered, or rediscovered, the yeast plant, but also boldly asserted that the life and growth of this plant was the cause, and not the consequence, of the alcoholic fermentation. Thus, based on solid grounds, began the biological or germ theory of fermentation of which Schwann is entitled to be regarded as the founder, precisely as Pasteur some twenty years later became the founder of its direct descendant, the germ theory of disease. Confirmed or even slightly anticipated by Latour in his discovery of the living and vegetable character of yeast; supported by Helmholtz and Mitscherlich in his assertion that no alcoholic fermentation of sugar ordinarily occurs except as caused by yeast; and by Schroeder and Von Dusch in his claim that the cause of fermentation and putrefaction in boiled liquids is not air, but floating matters in the air; Schwann is entitled to be regarded as the immediate precursor of the bacteriologists and as having effectually paved the way for the first and greatest of all bacteriologists, Louis Pasteur.

Of Pasteur, the founder of our science, I shall only recall very briefly the principal facts of history:

Pasteur brought to the study of all the problems that I have enumerated—and I hardly need remind you that among them are some of the most elusive, some of the most profound, and some of the most intensely practical, problems in all the field of natural knowledge—a thorough working familiarity with physics and chemistry. Though not exactly a chemist, he was able to meet chemists upon their own ground. Though not exactly a microscopist, he was highly trained in physics and mineralogy, and thus quickly became a master of the microscope. Piqued by the fact that living ferments could do with his salts what he himself could not do, he began a careful study of ferments and fermentation, with the result that in a few short years he had completely confirmed and established the biological or germ theory of fermentation propounded by Schwann; had extended it so as to make it include putrefactions; had shown that organic decomposition and decay in nature are simply slow fermentations or putrefactions; had nearly, if not quite, overthrown the world-old theory of spontaneous generation; had studied the floating matter of the air, and actually found in it organized corpuscles, or germs, of molds and of infusorial or fermentation animalcules; had invented and introduced for the first time methods for the cultivation, and even for the pure cultivation, of living ferments which so much facilitated the investigation of microscopic life that we now rightly regard them as constituting the very basis and essence of bacteriology,—which thus becomes a kind of microscopic gardening or horticulture of the microscopic world; had also, by the use of these

novel methods, established not merely the fact that living ferments in general are the cause of fermentation in general, but, what was of equal or even greater importance, the existence of specific or characteristic ferments for particular fermentations, one, for example, producing the alcoholic fermentation, another the lactic, a third the butyric, a fourth the acetic, and so on. If to-day we have to modify this primitive simplicity of arrangement and refer rather to one group of ferments than to one species merely, nevertheless the idea of specific energies for specific ferments remains secure and underlies most of the practical work of bacteriology.

Finally, through his work on industrial micro-biology, on the yeasts and the ferments of milk, vinegar, etc., Pasteur was led not only to consider the applications of bacteriology to the useful arts, but also to study the ailments of fermented drinks and the causes of their deterioration or 'disease,' with the result that in discovering and proclaiming the sources of the diseases of wine and beer as residing in specific noxious ferments or germs carelessly or unwittingly introduced, he became, almost unconsciously, not merely the apostle and defender of the biological or germ theory of fermentation, but also the principal contemporary exponent of the biological or germ theory of disease; a theory which had long been a dream of pathologists and now suddenly rose into scientific as well as popular favor.

Such was the origin of bacteriology, and such were some of the early achievements of its great founder. Stimulated by the work of Pasteur, a host of eager and enthusiastic workers threw themselves with intense zeal into the study of the micro-organisms which constitute the field of microbiology. Time has proved beyond all peradventure that the foundations laid by Pasteur were laid solidly and securely. The *fermentations* are in fact what he and his precursor Schwann believed them to be, viz., chemical changes produced by living ferments, which, taken together, we may call microbes. *Putrefactions* are, as Pasteur believed them to be, essentially anaërobic fermentations. *Present-day spontaneous generation* is, as Pasteur claimed, a myth—the last survivor of the notions of the alchemists. *Organic decomposition and decay* in nature have been found to be simply slow fermentations and putrefactions. *Nitrification*, or the natural mineralization of organic matter, is essentially an oxidizing fermentation, as is also, for example, the making of vinegar, from alcoholic cider. The *infectious or zymotic diseases* are either harmful fermentations, or the results of such fermentations, occurring not merely in wine, beer and vinegar, but, as Pasteur himself showed in the case of the silk-worm, in or upon the animal—and, we may now add, the plant—body.

A careful review of the subject from our present relatively advanced position shows that the really distinguishing characteristic of bacteriology is not merely its subject matter but its methods, not so much the peculiar organisms with which it deals—interesting and important though these are—as the peculiar means it has devised and employed for studying these organisms. In this respect bacteriology differs widely from any other science bearing the name of a particular class of plants or animals. Sciences such as mammalogy, ornithology, entomology, dendrology, pteridology, bryology, algology, mycology, lichenology and the like are chiefly, though not exclusively, characterized by the peculiarities of the special forms of life with which they deal, the methods by which they are pursued being largely common to all or at least in no great degree either peculiar or extraordinary. In bacteriology, on the contrary, owing, no doubt, to the small size and ap-

parent similarity of the organisms concerned, the ordinary methods of study and of classification are quite insufficient, so that new and highly peculiar methods have been devised and employed. Bacteriology does not depend, as ornithology and entomology chiefly do, on the external and internal anatomical features of individuals, but only to a small extent on these, and chiefly on the behavior of flocks, swarms, groups or masses of individuals, and upon these not in a state of nature but artifically massed or cultivated. Bacteriology finds its closest analogy not in such sciences as ornithology or bryology—the science of birds or the science of mosses—but in such sciences as breeding, gardening or agriculture. Possibly bee-keeping (apiculture) offers an analogy as useful as any. In apiculture bees are dealt with not so much as individuals, as communities or 'colonies,' and the swarms are bred, cared for or cultivated largely as masses and by methods highly peculiar. Bacteriology is a kind of microscopic horticulture or apiculture, and its methods, introduced in the first instance by Pasteur for yeasts and twenty years later vastly improved by Koch, are applicable to many bacteria and yeasts—though certainly not equally to all—and also to some molds and other fungi, and, to some extent, to certain algæ and protozoa. If we define as micro-organisms or microbes all organisms invisible or barely visible to the naked eye, we may conveniently describe their study as micro-biology. *Bacteriology* then *is a sub-division of micro-biology* and is conveniently defined as *the science of the culturable micro-organisms.*

Enough has perhaps been said already, in dealing with the origin of bacteriology, to indicate sufficiently the scope and significance of the culturable micro-organisms in nature. But when we reflect upon the simple fact that without their activity the habitable world and the sea would become one vast charnel-house, because there would be no adequate agency for mineralizing dead matter, we begin to realize the enormous importance of the part which they play in the economy of nature. We have only to think of their helpful and wholesome unseen activity in removing from our view the dead animal bodies which would otherwise cover the earth, the dead leafage of the autumn, the worn-out trunks of trees, and the waste matters of human and animal life, in order to appreciate in some measure their fundamental importance in nature. When to this we and their tendency to cause the destruction of valuable organic matters, such as food and timber; their function in producing those fermentations, putrefactions and poisonings of the human body which we know as epidemics, plagues, pestilences, infectious diseases, suppurating wounds, gangrene and the like; when, furthermore, we consider their causative participation in such universal, familiar and important processes as bread-making, brewing, vinegar-making, the fermentations of milk and its products, butter-making, cheese-making, lactic acid manufacture, tanning and nitrification, we are in a position to understand something of the scope and significance of the culturable micro-organisms, and therefore of bacteriology, from a practical point of view. And while we cannot forget that our science had its most fruitful beginnings in pure science at the hands of a physiologist, Schwann, and a natural philosopher, Pasteur, we must allow that its highest cultivation and its richest fruits have come from the labors of medical men. The names of Lister, Burdon-Sanderson, Koch, Behring, Roux and many others are the most famous, and their wonderful researches, with the brilliant practical results of their labors for human welfare and progress, by far the most splendid achievements of bacteriology in the last

quarter of our century,—the post-Pasteur period.

But in the last analysis it is the higher significance of bacteriology which must always be regarded as its most important characteristic. By virtue of the discoveries upon which it was founded, to which it has led and upon which to-day it rests illustrious and secure, mankind has been enabled for the first time to arrive at an adequate comprehension and understanding of the microscopic world and of many important and familiar natural phenomena hitherto either not understood or misinterpreted. The origin of bacteriology is interesting and instructive; its scope is broad and comprehensive; but these matters are of only moderate consequence as compared with its philosophical significance. At the beginning of our century, in absolute ignorance of bacteriology and its wonderful teachings, man gazed with wonder or indifference on some of the most familiar, yet most mysterious, of natural phenomena. Organic matters almost everywhere slowly 'decayed' and disappeared; sweet and sugary fruit juices 'turned' rapidly and 'spontaneously' into pungent or acid liquors; slow and innocuous 'decomposition' often gave place to foul 'putrefaction' and rapid 'decay' or destructive 'rots'; manure applied to land, even to land lying fallow, soon vanished altogether; 'epidemics, "plagues' and 'pestilences' swept over the earth, and man could neither understand, nor explain, nor intelligently fight them; the microscopic world quivered with forms of life which seemed to be born in a day and to disappear like dew. The heavens had long since revealed the glory of God, and the firmament,—thanks to the interpretations of Copernicus, Galileo and Newton,—had abundantly shown his handiwork. But the microscopic world still sat in the shadow of darkness, awaiting the disclosure of its meaning. At last, in the fulness of time and largely through the achromatic objective, a great light shone upon and from the under world. The mysteries of fermentation, putrefaction, organic decomposition, decay and the mineralization of organic matters were reduced to their lowest terms and brought into line with other problems of biology. Epidemics, plagues and pestilences were proved to be merely the ravages of micro-parasites; the life of the under world was scrutinized, classified and studied, and has been found to follow in general the same natural laws as that of the upper world. Bacteriology has given to us a comprehension of the under world similar to that which astronomy and astro-physics have given us of the heavens; the widely-accepted theory of present-day spontaneous generation has been proved to be a myth, and with the fading out of this ancient view of nature the last traces of medieval ideas of magic, alchemy and easy transmutation of the elements have disappeared from science.

William T. Sedgwick.
Massachusetts Institute of Technology.

CERTAIN STROBOSCOPIC PHENOMENA IN THE END-ON PROJECTION OF A SINGLE WAVE.

In projecting a plane polarized wave machine wave, *ww*, with a lens on a distant screen, *S*, one observes when the wave is in vigorous motion that the balls appear on the screen as stationary objects, symmetrically disposed with reference to the axis of advance of the wave, or the direction of incident light, *LL*, and at distances apart corresponding to equal phase-differences. Clearly the same effect must be produced in rotating the circle of reference, *C*, if provided with balls, *a*, *b*, *c*—at equal angular distances apart on the circumference. As certain parts of this phenomenon are peculiar, I constructed a disk like *C* by soldering bright rods at right angles to its surface at *a*, *b*, *c*—with an axle at *C*.

When the disk revolves, however rapidly, in the beam of sunlight parallel to its surface as stated, the eye regarding the *inner* surfaces of the rods *a*, *b*, *c*, *d*, *e*, sees the usual sheen of light intersected with intensely black shadow bands due to *f*, *g*, *h*, *i*, *j*, projected in the positions *a*, *b*, *c*, *d*, *e*. The experiment is specially striking in a dark room. This phenomenon is easily explained, for the points *a*, *b*, *c*—are nodal points, as it were, or loci of perpetual eclipse.

The second phenomenon is even more striking: if the light after passing the revolving disk parallel to its face (which therefore is seen as a mere line) is caught on a screen, either close at hand without a lens, or at long range by lens projection, the loci α, β, γ, δ, ε, are again stationary, appearing however *bright* on a dark ground. Judged merely by the eye, the effect is just as if the rods where they cross in double thickness were perfectly transparent. It would take considerable acumen to predict this kinematic result.

Without entering into details, I may point out in explanation that every part of the area of projection, *S*, is swept by the shadow of each rod twice per rotation. The result must be perceptible and at first sight uniform darkening of the field. But whereas throughout the whole semicircle, *f*, *g*, *h*,—and also *between* the points *a*, *b*, *c*,—light has been removed backwards (*i. e.*, from the screen) by reflection, none has been removed at the points *a*, *b*, *c*; for these appear as black lines in the sheen of revolving rods. Hence more light must get through along the lines *fe*, *gd*, *hc*, than in the same direction between these lines.

C. BARUS.

BROWN UNIVERSITY.

THE INTERNATIONAL GEODETIC ASSOCIATION.

THE sessions of the Thirteenth General Conference of the International Geodetic Association were held at Paris, France, between the 25th of September and the 6th of October, 1900.

The following countries were represented at the Conference: Germany (8), Austria (2), Denmark (1), Spain (1), United States (1), Great Britain (1), Hungary (1), Italy (3), Japan (1), Mexico (2), Norway (1), Holland (3), Roumania (2), Russia (1), Sweden (1), Switzerland (1), France (8), the number following the name of each country indicating the number of delegates sent from the country. Belgium, Greece and Portugal were not represented.

At the opening session of the Conference the French Minister of Public Instruction presided, and welcomed the delegates in the name of the French Government. The sessions were held in the new Sorbonne, and a great many interesting reports were read. From these reports the following details have been extracted:

M. Schumann has undertaken a new computation of all the great arcs already measured, in order to deduce the elements of the terrestrial ellipsoid.

By relative gravity measures, M. Schumann has connected Königsberg, Guldenstein, Copenhagen and Christiania with Potsdam.

M. Borrass has connected Bucharest with Potsdam; M. Nagaoka will soon connect Tokio with Potsdam; and M. Putnam has recently connected Washington with London, Greenwich, Kew, Potsdam and Paris.

The funds of the association will be used to effect other connections of the principal gravity stations of Europe.

M. Helmert continues to keep up complete statistics of relative gravity stations. The actual number of these stations is now 1,450, of which 83 are connection stations. The results are very numerous, and the exact connection of the principal stations is an accomplished fact. M. Helmert hopes to be able, in 1901, to give a comprehensive discussion of all the results so far obtained.

A report was made upon the observations already made at international latitude stations, and the provisional calculations of the observations so far made have given satisfactory results.

General Bassot suggested the desirability of making similar observations on a parallel in the Southern Hemisphere.

The labors of Albrecht and Chandler have made great progress in developing the theoretical question of the variation of latitude. The first, from observations at 13 stations in Europe and America, from 1890 to 1897, has shown that the pole of rotation of the earth has described in that space of time an irregular spiral about a mean position, with a maximum elongation of 0″.30. The second, after a profound discussion of observations made between 1825 and 1893, represents this displacement by an expression of two terms, periodic functions of time. The period of the first oscillation covers 429 mean days, that of the second 365. These terms vary, respectively, from 0″.085 to 0″.185 and from 0″.115 to 0″.135. The mechanical causes of the displacement of the terrestrial axis of rotation are still far from being known.

A resolution was passed requesting Professor Gore to prepare a new edition of his *Bibliography of Geodesy*, issued by the Coast and Geodetic Survey in 1889.

A special report on triangulation was made by General Ferrero, and on base lines by General Bassot.

The French Geographic Service has undertaken a revision of all the French triangulation, with the aid of the instruments and methods of high precision used in the New Meridian of France; and work is actually in progress on the parallel of Paris.

In Italy the geodetic junction of Malta and Sicily has been made.

Roumania submitted her first report of geodetic work. The arc of the parallel already measured between the Atlantic Ocean and the Danube has been extended across Roumania to the Black Sea, and the meridional arc measure by Struve between the Arctic Ocean and the Danube has been extended entirely across the country.

In Russia the recomputation of all trigonometric points upon the same spheroid has been undertaken. A determination of the terrestrial elements from Russian arcs alone shows that the elements of Bessel conform more nearly to the curvature within the boundaries of Russia than those of Clarke.

Two proposed operations were submitted to the Conference:

The Observatory at Nice will undertake experiments to determine the velocity of sound and light, using the distance between Mt. Mounier, near Nice, and Mt. Rotondo, in Corsica. This distance will be redetermined with modern precision by the French and Italian geodesists.

The difference of longitude, Paris-Greenwich, will again be determined according

to an elaborate program. One determination will be made in October, 1901, and another in March, 1902, so that the first results can be discussed before undertaking the second set of observations. Two pairs of observers, using four instruments, as nearly similar as possible, will be employed. At each station the French and English observers will frequently exchange their instruments. The pairs of instruments and observers will be exchanged twice during each determination. The method employed will be submitted to the examination and approval of the Central Bureau of the Association.

In this connection M. Albrecht called attention to the advantage of using the registering micrometer of the Repsold system, which eliminates the personal equation of observers.

Mr. Foerster spoke of errors resulting from the instability of the optical axes of instruments, caused by the movement of the objectives in their mounting.

General Bassot emphasized the necessity of watching attentively the nature and constancy of the electric communication, whose variability may explain the marked differences.

M. Cornu exhibited and explained an apparatus to determine the zenith distance of a star culminating near the zenith. On motion of M. Hirsch the Association resolved that a similar apparatus should be constructed and studied in one of the great observatories, and that M. Cornu, continuing his useful studies, should realize a portable zenitho-nadiral apparatus for use in temporary observatories, permitting numerous and easy determinations of latitude at all the points of a geodetic net.

Upon the invitation of the Association, M. Guillaume, of the International Bureau of Weights and Measures, presented a very interesting communication concerning nickel-steel. He remarked in 1896 that nickel-steel, with 30 per cent. nickel, had an expansion sensibly less than platinum, and since then has conducted most interesting studies concerning these alloys. He dwelt upon their singular magnetic, thermometric and mechanical properties, and stated that a certain alloy with 35 per cent. to 36 per cent. nickel possesses an expansion ten times less than that of platinum and twenty times less than that of brass. He then passed to the uses of the alloy for geodetic purposes. He considers it impracticable to use the alloy in the construction of standards of the first order, where perfect stability and invariable dimensions within the limits of precision measures are demanded for long periods of time, on account of certain changes which have been observed as a function of time. In geodesy the question presents a different aspect, and it suffices in practise that the length varies very little, say a millionth part in a year, and that the change should be very regular. The small coefficient of expansion, the malleability, the feeble oxidation, and the homogeneous character of these alloys all increase their usefulness in the construction or use of geodetic instruments.

The applications of nickel-steel have passed the experimental stage and entered the practical field in the two methods of measuring bases actually in use, viz., those of rigid bars and wires.

The problem of constructing a base bar has been solved in a very satisfactory manner in the one actually being constructed for the Geographic Service of the French Army, from the plans of MM. Benoit and Guillaume. The bar, which is four meters long, has a section in the form of an H inscribed in a square of 40 millimeters. It is enclosed in a case, made of an alloy of aluminum, with openings for necessary observations. It rests in its case on two normal points of minimum flexure. It weighs 50 kilos, case included.

Nickel-steel wires have been made and furnished to the Geographic Service of the French army, to the Swedish-Russian Expedition to Spitzbergen and to the Geodetic Service of Cape Colony, for experimental use.

Work in Spitzbergen is in progress under the extremely difficult climatic conditions usually found in this region. The missions sent out by the two Governments were engaged in field work from the last of June to the beginning of September. They are now in winter quarters, isolated from the rest of the world during nine months, engaged in making astronomical and meteorological observations and in studying gravity, refraction, etc.

Sir David Gill addressed the Association on the motion of Professor Darwin, the delegate from Great Britain. He announced that since the publication of the first volume of the Geodetic Survey of South Africa, two extensions of the Geodetic Survey have been undertaken there. The first was required for the purpose of delimiting the boundary of British Bechuanaland and German Southwest Africa; with the cordial cooperation of both governments concerned, it was arranged to carry out this work as far as latitude 22° S. with the accuracy of a geodetic operation.

Connection was made with previous work, and the combination of these observations secures the measurement of a latitude arc along the 20th meridan from Cape Agulhas, (the southernmost point of Africa), to latitude 22° S.—an arc of nearly 13°.

The second operation is the more important of the two, and provides for the extension of an arc along the 30th meridan of E. longitude, from the southern border of Rhodesia (22° S.), to the southern end of Lake Tanganyika. The work owes its inception to the enlightened policy of the Chartered Company, which has accepted the results of all experience and has determined to base its surveys of the country on a framework of the most accurate possible triangulation. The work has been in progress for some years and a chain of triangulation has been carried along the 30th meridian from Gwelo (lat. 19½° S.) to the Zambesi.

Sir David Gill plans an extension of this work to Alexandria, Egypt, with the cooperation of Germany and Belgium through their African possessions, and of the Egyptian Government, and sees no special difficulties in the way of accomplishing the measurement of this great meridional arc, covering 66° of latitude.

Splendid as is the scientific prospect which the realization of these projects would present, its importance is further enhanced by the consideration that by the execution of a triangulation around the Levant to join Struve's great arc of the meridian (which extends from the North Cape, in Norway, along the 30th meridian to the southern limit of Russian territory), an arc having an amplitude of 104° would be completed.

A resolution was adopted expressing appreciation and approval of the project proposed by Sir David Gill.

The new measure of the Equatorial Arc of the meridian, known as the Peruvian Arc, undertaken by the Geographic Service of the French Army, was discussed by the Association with great interest. Captains Maurain and Lacombe, of this service, spent five months in South America during 1899, and finished the reconnoissance, during this time, of an arc of 6°, extending the old arc 1° on the north and 2° on the south. The scheme includes base lines, azimuth stations, astronomical observations, leveling, gravity and magnetic observations, topographical work and geological investigations.

The French Minister of Public Instruction referred the report of MM. Maurain and Lacombe to the French Academy of Sciences

for a statement whether the interests of science required this long extension of the arc, and the Academy has replied, through M. Poincaré, that the arc should be extended to 6°, and that the Academy should exercise a scientific control of the work through a permanent commission, but that the actual work on the ground should be confided to the Geographic Service of the French Army.

The sentiment of the Association was in favor of the prompt execution of this work. It was stated that two officers would shortly leave for South America to finish all preliminary preparations, and that three other officers and their staff would probably start about the last of April, 1901, to take up the field work. A French astronomer is already in charge of the observatory at Quito, under appointment from the Government of Ecuador.

During the discussion of the project for a great meridional arc in Africa, proposed by Sir David Gill, the Astronomer Royal at the Cape of Good Hope, I had occasion to make the following remarks, in response to the request of Professor Darwin for some statement from the delegate of the United States in reference to the suggestion offered by General Bassot, one of the French delegates, that in America there was an opportunity of measuring an arc of the meridian from Cape Horn on the south to the Arctic Ocean on the north:

"In response to the request of M. Darwin, I have the honor of expressing my appreciation and admiration of the grand scheme of triangulation proposed by Professor Gill, Director of the Observatory of the Cape, and take pleasure in stating that the motion for its endorsement by the International Geodetic Association will receive my earnest support. I will present the plan to my government and feel confident that it will receive all possible support from the geodesists of my country.

"In reference to the suggestion of General Bassot that a great meridional arc might be measured in America, I have to state that the United States is now engaged in measuring an arc along the 98th meridian west of Greenwich, which will extend entirely across the country and cover 23° of latitude.

"The details of the condition of this work at this time will be found in my report to the Association.

"This arc can be extended south 9° of latitude by Mexico, and north by Canada to the limit of ice and snow in the Arctic regions, an unknown distance. I do not think that my Government is prepared to undertake any extension of the above scheme at present."

After discussing Sir David Gill's scheme, the Association indicated its approval by a unanimous vote.

When the report on the new measurement of the Equatorial Arc (known as the Arc of Peru), was before the Association, I took occasion to make the following statement:

"The delegate on the part of the United States desires to express, in the most positive manner, admiration and appreciation of the work already accomplished by the French geodesists, as shown in their report on the reconnoissance of the Arc of the Meridian of Quito, and to extend to them the most cordial congratulations.

"Feeling the deepest interest in the prosecution of the work and in its successful completion, he trusts that no serious obstacle will cause delay.

"Its ultimate completion is assured, now that it has been undertaken by those who will make any necessary sacrifice to add this additional glory to the illustrious position already attained by French geodesists.

"If assistance of any kind is needed to complete the work, he hopes that his country will be given preference in doing all in its power to supply whatever is demanded by the exigencies of the case."

ISAAC WINSTON.
U. S. COAST AND GEODETIC SURVEY.

THE ALBANY MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA.

II.

Stereographic Projection in Map-Construction: SAMUEL L. PENFIELD, New Haven, Conn.

By means of lantern slides and diagrams, Professor Penfield illustrated the methods of projecting maps of the various parts or countries of the globe upon the plane of its equator or of any other great circle. The methods are those employed by crystallographers for the projection of the polar points

of crystals and possess many advantages over the Mercator's projection or the ordinary maps which are practically pictures without definite mathematical proportions. Professor Penfield has constructed a series of scales which correspond to the projections of arcs by the stereographic method, and which enable one to measure distances between points of the earth whose latitudes and longitudes are known. Great accuracy can be obtained even when the projections are made on a circle whose diameter is less than six inches. The paper appears in the January number of the *American Journal of Science* and should be read by all teachers of geography.

The Paleozoic Limestones of the Kittatinny Valley, N. J.: Henry B. Kümmel, Trenton, N. J., and Stuart Weller, Chicago, Ill.

The Paleozoic limestones of the Kittatinny Valley are divisible into the Kittatinny formation below and the Trenton above. The former is a magnesian limestone, probably 3,000 feet thick, and ranges from lower Cambrian into the Calciferous, with no structural or marked lithological differences. The Trenton limestone, about 135 feet thick, carries in its lower beds the Black River fauna, making it the equivalent of the lower Trenton of New York. A conspicuous and widespread basal conglomerate at the bottom of the Trenton rests upon the eroded surface of the Kittatinny formation. The lithological and faunal characteristics of the formations were described and their structural relations shown. The extent and importance of the basal conglomerate were outlined.

In discussion, M. R. Campbell inquired if the Trenton conglomerate changed in thickness from northwest to southeast. Mr. Kümmel replied that it did not, generally, although there was some variation in that the conglomerate appears to have been formed at the foot of cliffs. Mr. Campbell stated that he had noted somewhat similar relations in Virginia, but that the conglomerate appeared on the northwest sides of the valleys and not on the southeast. He explained it as due to an interval of erosion and to the direction of the currents. N. S. Shaler cited parallel conditions in Kentucky and remarked the tendency of the limestones to thicken toward the northwest, not only in the Trenton but in the Lower Carboniferous and in the Coal Measures as well. He explained this by an Appalachian island to the eastward. J. M. Clarke mentioned a basal conglomerate in the Trenton near Albany, with fossiliferous pebbles containing a different fauna from the cement. J. F. Kemp cited a conglomerate of boulders of gneiss enclosed in a limestone cement in the thin Trenton outlier, within the southern Adirondack crystallines, at Wellstown, N. Y. The boulders are several inches in diameter, are similar to the neighboring gneisses and have apparently been dropped by floating ice. T. C. Hopkins remarked the Trenton conglomerate of the Nittany Valley, Penn., and its likeness to that of New Jersey.

The Niagara Group along the Western Side of the Cincinnati Anticline: Aug. F. Foerste, Dayton, Ohio.

The paper described the lithology, paleontology and physiography of the Niagara Group, with special reference to Middle Tennessee. It was the continuation of an investigation which had been partially described to the Society at a previous meeting, and which had for its object the determination of the time of upheaval and the structural relations of the Cincinnati uplift. Mr. Foerste traced the several component strata from north to south on both sides of the great fold, from Ohio into Central Tennessee, and especially emphasized the excellent section presented at Newsome, Tenn. He

had observed that the Clinton fossils of New York occur at higher and higher horizons as one goes westward, and by this observation he was led to correct some previous errors of correlation. He placed the crest of the fold farther west than is ordinarily done, and made the upheaval later than the close of the Ordovician and earlier than the Hamilton, whose shale goes unconformably over the strata on the flanks.

At the conclusion of the paper the Society adjourned for lunch. On reassembling the program was continued as follows:

The Knoydart Formation in Nova Scotia—a bit of the 'Old Red Sandstone' of Europe: H. M. AMI, Ottawa.

The presence of such genera as *Pteraspis*, *Pterygotus Onchus*, etc., in the red marls, shales and calcareous breccias (?) of McArras Brook in Antigonish and Pictou counties, Nova Scotia, indicates the base of the 'Old Red Sandstone' of Great Britain. The paper discussed the relations, paleontological and stratigraphical, of this important formation in the sequence of Devonian strata in eastern Canada. The result of observations made by Mr. Hugh Plebden, of the Canadian Geological Survey, as published on this subject, together with important notes by Mr. A. Smith Woodward and Dr. Henry Woodward, of the British Museum, was embodied in the paper.

The names applied by Mr. Ami to the several formations of this section are the following:

The Silurian of the Arisaig Coast of Nova Scotia is divisible into at least four distinct geological formations, and includes:

1. *The Stoneham formation*, consisting for the most part of dark red and fine grained shales and mudstones, holding a conspicuous, lamellibranchiate fauna, of which *Grammysia Acadica*, Billings is a well-known species, together with a number of interstratified, more or less thin, calcareous bands, holding brachiopods, gastropods, trilobites and ostracods in abundance.

2. *The Moydart formation* consisting of more or less heavy bedded, light greenish-gray and rusty weathering, calcareous strata, in which the author's 'Red Stratum' occurs—holding brachiopods, cephalopods, crinoids and gasteropods.

3. *The McAdam formation* consisting for the most part of impure, black, carbonaceous, at times splintery shale, holding a lamellibranchiate fauna, graptolites, etc.

4. *The Arisaig formation* including buff-weathering, fine grained and compact mudstones and shales, holding corals, chiefly Streptoplasma and brachiopods, gastropods and trilobites.

5. *Knoydart formation* red shales and sandstones and calcareous bands, holding pteraspidian and ostracoderm fishes and crustaceans, referable to the Cornstone or lower Old Red Sandstone of Great Britain. It immediately overlies the Silurian strata at Arisaig, but no actual contact has been observed.

H. S. Williams inquired about the igneous rocks at the top and in further detail regarding the Knoydart formation. Mr. Ami replied that igneous rocks were present. The strata had been mapped as upper Devonian, but that they really were lower Devonian and possessed a pronounced Silurian facies. The whole series is much more closely related to the British fauna than to that of Anticosti.

A Depositional Measure of Unconformity: CHARLES R. KEYES, Des Moines, Iowa. The paper was read by W. B. SCOTT.

The great unconformity at the base of the Coal Measures in the upper Mississippi Valley was briefly characterized in its various aspects. The enormous thickness of Coal Measures in Arkansas and Indian Territory finds adequate explanation in the ancient geographic development. The recent

results of correlation of the north and south regions were summed up. Twenty thousand feet of the Arkansas Coal Measures are found to have been deposited during the period represented by the great stratigraphic break in the north. No discussion.

Marine and Fresh-water Beaches in Ontario. A. P. Coleman, Toronto, Canada.

Marine deposits, often rich in shells and other fossils, are widely distributed east of Brockville and Smith's Falls, in the valleys of the Ottawa and St. Lawrence. They occur at higher levels toward the northeast and east than towards Brockville; they include trees and other forms indicating a climate like that of to-day, and are all evidently postglacial. The shells occur in clay, sand and also coarse gravel.

High beaches, such as the Iroquois, Warren, etc., contain only fresh-water shells, if any. Still higher beaches, such as those reaching 1,400 to 1,600 feet above sea level in the highlands between Georgian Bay and Lake Huron, and the beaches found above 1,400 feet between Lake Superior and Missanabie, and at the same level on the Hudson Bay watershed northwest of Sudbury, have not yet been found to contain shells, although if marine there must have been complete and widely opened connection with the sea. The wide gravel terraces on the watershed mentioned contain numerous and large, kettle-shaped, lake basins, sometimes without outlets, suggesting that they were formed by the burial of large blocks of ice at the border of the Labradorian ice sheet, and hence in ice dammed waters.

In discussion Robert Bell explained the presence of fresh-water shells amid marine conditions because of the forcing back of salt water by an inflowing stream of fresh. On the north side of Lake Superior he cited the occurrence of marine shells up to 500 feet, but their absence in the high gravels. He argued against the existence of ice dams in the past. G. K. Gilbert described the phenomena along the St. Lawrence east of Lake Ontario. He cited the occurrence of marine shells as far as Ogdensburg. C. H. Hitchcock referred to the sea-shore plants that are found around Lake Superior, apparently left by the withdrawal of the salt water. He also suggested that the basin of Lake Ontario might be due to the removal of limestone in solution. F. B. Taylor discussed the shell-beds, beaches and ice-dams. H. P. Cushing instanced the high gravels and general physiography of the Adirondacks as bearing on the questions. The Adirondacks embrace the high mountains, the western peneplain plateau and the depressed lakes. Kettle-holes occur on the north side but not on the south. Ice dams are proved by the kames left by subglacial streams which flowed against the slope of the country.

The Geology of Rigaud Mountain, Province of Quebec, Canada: Osmond Edgar Leroy, Montreal, Can. Introduced by F. D. Adams.

The chief topographic feature of the Paleozoic plain of Central Canada is a series of hills, which occur in the district about Montreal. These are of igneous origin, and follow a line of disturbance which is almost at right angles to the trend of the Notre Dame Mountains. Rigaud is the most western of the series. It consists of an area of hornblende syenite, which is pierced on its northern flank by a quartz syenite porphyry. The field relations of all the hills with the exception of Rigaud, show them to be of post-Silurian age. In the case of the latter, the contact with the Paleozoic is wholly concealed by drift. The object of the research was to ascertain if a genetic connection could be established between Rigaud and the other hills to the east.

Investigation shows that it is probably

not so connected, but a definite conclusion cannot be reached until a more extended study is made of the rest of the range.

In discussion, F. D. Adams commented on the interest attaching to this mountain both in its petrographic and stratigraphic relations. Mention was made by others of the benches of boulders which lie on the side of Rigaud. It was brought out that they are coarse cobbles, entirely unglaciated and all of local origin. They are known as the Devil's Garden and are at least thirty feet deep, but have no fine material between them. N. S. Shaler, therefore, remarked that they could not be beach-deposits, else they would be packed with sand. The interpretation of the boulders is an interesting point in post-glacial geology, but it still remains to be solved. J. F. Kemp remarked the similarity of the syenite to that of the Adirondacks, especially as described by H. P. Cushing in an earlier paper.

At the conclusion of Mr. Leroy's paper the session adjourned.

In the evening the Society was most hospitably entertained by Dr. and Mrs. F. J. H. Merrill and had the opportunity of meeting many Albany people.

On reconvening on Saturday morning the most important executive business was the adoption of a resolution recommended by the Council, which read as follows:

Resolved, That recognizing the great, historical, scientific and economic value of the collections of the State Museum in Albany, representing the geology and paleontology of the State of New York, the Geological Society of America expresses the earnest hope that an ample and fireproof building may be provided for the display of the priceless collections, where they may be accessible to students interested in the progress of science and the economic development of the State.

The Society then listened to the Presidential address of Dr. George M. Dawson, who took for his subject 'The Geological Record of the Rocky Mountain Region.' The paper was illustrated by maps and by comparative stratigraphic sections both east and west of the Canadian Rockies. It dealt especially with Canada and will be probably printed in full in a later number of SCIENCE.

The following paper was read in abstract by G. P. Merrill.

Weathering of the Granitic Rocks of Georgia: THOMAS L. WATSON, Atlanta, Ga.

The paper embraces the results of a detailed field and laboratory study of the principal exposures of the granitic rocks in Georgia. On structural and textural grounds, the rocks were divided into and discussed under (*a*) the true granites with even-grain texture; (*b*) porphyritic granites; and (*c*) granite-gneisses. Each type, as here distinguished, is represented by a number of localities in somewhat widely separated parts of the State. In mineral and chemical composition, the rocks are closely similar, and all carry biotite as the chief accessory.

The physical conditions of the fresh rock and of its accompanying, decayed product as studied in the field were carefully stated, and each was described petrographically, the description being followed by a discussion, based on chemical analyses, of the changes incident upon weathering.

In taking up the changes manifested in the weathering of the rocks, as shown in the analyses, calculated amounts of each constitutent lost and saved were separately made on three assumptions, namely, that the Fe_2O_3, the Al_2O_3 and the $Fe_2O_3+Al_2O_3$ have undergone no loss. The results were then compared. With the exception of the total loss for the entire rock, the results proved to be closely similar for the three assumptions.

The Peneplain of Brittany: W. M. DAVIS, Cambridge, Mass.

The paper consisted of an exhibition of lantern slides illustrating the peneplain of Brittany, and of its detached portions in Jersey and Belle Isle, as well as of certain valleys by which the peneplain has been dissected since its elevation; and of comments in which the speaker argued that the plain was not one of marine denudation, but was subaërial.

The paper led to a quite extended discussion of the criteria for plains of marine origin, chiefly emphasized by N. S. Shaler and H. M. Ami, and of those of subaërial character, as developed by C. D. Walcott and G. K. Gilbert.

An Excursion to Colorado Canyon: W. M. Davis, Cambridge, Mass.

Observations made in the canyon of the Colorado and over the plateaus on the north and south, during a three weeks' trip in June, 1900, add the occurrence of certain landslides and migrating divides to the evidence already stated by Dutton in favor of two cycles of erosion in the development of the Grand Canyon district; the broad denudation of the plateaus having been accomplished in the first cycle, and the incision of the narrow canyons in the second. The faults by which the plateaus are divided are regarded as for the most part of greater antiquity than the canyon cycle; the antecedent origin of all the branch streams of the Colorado in this district is questioned; and the high level floor of the Toroweap valley is explained otherwise than by the failure of its former water supply through a change from a humid to an arid climate.

G. K. Gilbert corroborated the probability of the speaker's views from the evidence of neighboring systems of drainage, and C. D. Walcott spoke in the same vein.

Fossiliferous Layers in the Calciferous of Dutchess County, N. Y.: W. B. Dwight, Poughkeepsie, N. Y.

The paper described some recent discoveries of a Calciferous fauna, somewhat related to the Fort Cassin fauna of Vermont. It seems to identify the Calciferous for the first time so far south. It contains 24 species, of which 9 are trilobites.

C. D. Walcott remarked its resemblance to the fauna at Phillipsburg, Vt., and to another at Eureka, Nev.

Glacial Phenomena in Eastern Ontario: F. B. Taylor.

The speaker described the results of his observations of the moraines and other glacial phenomena in the portion of Ontario lying between Georgian Bay and Lake Ontario. At least four moraines can be identified which he endeavored to trace out to a connection with those further south. He also described an old river channel near Guelph which had been produced by a stream flowing against the front of the ice sheet.

The paper was discussed by W. M. Davis and A. P. Coleman. The former emphasized the importance of accurate phraseology in the nomenclature of glacial forms, the latter corroborated the general conclusions of Mr. Taylor in respect to the local geology.

Biserial Development in the Plates of the Arms of Crinoids: A. Grabau, Troy, N. Y.

By means of a series of diagrams the speaker showed how the arms of crinoids begin with a uniserial set of plates, and then by the development of a series of wedge-shaped plates gradually become biserial.

The Atchison Deep Well, Kansas: E. Haworth, Lawrence, Kansas.

The paper was read in abstract by J. F. Kemp in the absence of the author. It described a recent deep well at Atcheson which revealed two workable coal-seams and which threw new light on the structural relation of the Coal Measures and Lower Carboniferous strata in this section.

The following papers were read by title:

Sand Crystals and their Relation to certain Concretionary Forms: ERWIN H. BARBOUR, Lincoln, Nebr.

The Broad Valleys of the Cordilleras of North America: N. S. SHALER, Cambridge, Mass.

Keewatin of Eastern Central Minnesota:

Keewenawan of Eastern Central Minnesota: C. W. HALL, Minneapolis, Minn.

Points Involved in the Silurian-Devonian Boundary Questions: H. S. Williams, New Haven, Conn.

Age of the Coals at Tipton, Blair Co., Pa.: DAVID WHITE, Washington, D. C.

Comparison between the Stratigraphy of the Black Hills and that of the Front Ranges of the Rocky Mountains: N. H. DARTON, Washington, D. C.

Tertiary History of the Black Hills: N. H. DARTON, Washington, D. C.

The Wisconsin Shore of Lake Superior: G. S. COLLIE, Beloit, Wis.

Landslides of the Echo and Vermilion Cliffs, Grand Canyon of the Colorado: RICHARD E. DODGE, New York City.

The Society then passed the customary votes of thanks to the local Fellows and with them closed a very successful meeting.

J. F. KEMP.

COLUMBIA UNIVERSITY.

ANTHROPOLOGY AT BALTIMORE.

SECTION H of the American Association for the Advancement of Science held its winter meeting at Baltimore, Maryland, on December 27th and 28th, in conjunction with the meetings of the American Society of Naturalists and Affiliated Societies.

Vice-President Butler being unavoidably absent, Professor Franz Boas was elected temporary chairman at the Thursday morning session which was called to order at 10.15 o'clock in the Historical Seminary Room at Johns Hopkins University.

The first paper read was by Dr. Thomas Wilson, on 'Anthropological Congresses at the Paris Exposition of 1900.' After a brief sketch of the history of the Congrès International d'Anthropologie et d'Archéologie Préhistorique, Dr. Wilson gave a summary of the work done at the recent sessions at Paris and described the field excursion. An account was also given of the meeting of the Congrès International des Américanistes. This Society has accepted the invitation to meet in New York city in 1902. On the motion of Dr. Wilson a committee of three was appointed to take preliminary steps for the reception of the Congress at this, its first meeting in the United States. The committee appointed consists of F. W. Putman, chairman, J. W. Powell and G. A. Dorsey.

The next paper, entitled, 'The McCormick Expedition among the Hopi,' by Dr. G. A. Dorsey, described the archeological work done along the Little Colorado River by a party from the Field Columbian Museum and by another party in the vicinity of the Hopi pueblos. The ethnological work of Mr. Voth was also described and commended. This paper will be published in SCIENCE.

Professor Franz Boas next spoke of the desirability of a catalogue of the crania now in American museums. In order that the various collections may be worked up in a uniform manner, standard skulls should be sent to each museum from which the measurements to be taken might be learned and the extent of error in observation reduced to a minimum. The Section was unanimous in its approval of Professor Boas's plan and it was voted to refer the preparation of a report upon osteological cataloguing to the Anthropometrical Committee of the Association.

Dr. Frank Russell then demonstrated a

new instrument devised for the purpose of measuring the torsion of the long bones. The features of the instrument were simplicity, ease and rapidity of manipulation and accuracy.

Dr. Walter Hough gave an ethnographic sketch of the Totonac Indians of Mexico, concerning whom but little has heretofore been known.

A second paper by Dr. G. A. Dorsey, on 'An Aboriginal Quarry in Eastern Wyoming,' closed the morning session.

Upon reassembling in the Historical Seminary Room Professor Boas withdrew from the office of chairman and Dr. Frank Russell was elected to that position.

The first paper of the afternoon was by Professor O. T. Mason, on 'Technique in Amerindian Basketry.' In the absence of the author the paper was read by Dr. Hough. All American baskets are of two types: woven or plicated and coiled. The forms of woven baskets were enumerated, with examples of each. The varieties of twined and of coiled basketry were classified and described.

Professor Boas followed with an account of his summer's work among the Kwakiutl Indians of the Northwest Coast, speaking particularly of their language. He commented upon the changes that are taking place through contact with the whites, also the change from the paternal to maternal descent in the social organization of the tribe. In the discussion which followed Dr. Fewkes pointed out the similarity between the measurements in use among the Kwakiutls and those of the Hopi, and also spoke of the customs regarding property, especially the ownership of eagles. The different clans have traditions that they came from different quarters, and the eagles' nests in those directions are not disturbed by the members of other clans.

The paper upon 'The Interpretation of Field Testimony, especially concerning Village Sites,' by Mr. W. K. Moorehead, was read by Dr. Wilson.

The Section meeting at 9 o'clock on Thursday morning in the Physical Laboratory was presided over by Professor McGee. An illustrated paper was read by Mr. Geo. G. MacCurdy, on 'Folk-Religion in Brittany.' The author described a ceremony at the church of Carnac dedicated to St. Cornély, patron of domestic animals, where live cattle are offered not only for the Saint's blessing, but also as gifts to him. At a chapel near Brussels, dedicated to St. Guidon, horses appear prominently on certain festival days. Figurines of horses and cattle used in Bohemia, Styria and Bavaria offer a striking parallelism with the Hopi figurines of domestic animals used at the winter-solstice ceremony.

Mr. Harlan I. Smith presented an illustrated paper, entitled, 'Notes upon the Archeology of the Sagwan Valley, Michigan.' These notes were selected from those taken by the author in 1890 which are now being edited for the purpose of rendering them available to the State Survey which prominent educators of Michigan are advocating. Notable among those who are endeavoring to establish an archeological survey of the State of Michigan are the University of Michigan and the Detroit Branch of the Archeological Institute of America. After discussing the paper and the desirability of extending such surveys, the Section appointed a committee consisting of Thomas Wilson, chairman, G. A. Dorsey and Frank Russell to transmit a suitable memorial to the people of Michigan expressive of its approval of the establishment of the survey.

Dr. Frank Russell exhibited a series of lantern slides made from photographs which he had taken in Arizona during the summer of 1900. This communication was avowedly presented for the purpose of eliciting information concerning the present state of our

knowledge concerning the pictographs of the southwest. In the discussion which followed Dr. Fewkes pointed out the value of these symbols to those who are studying the routes of migrations in the Southwest. He also offered interpretations of several of the characters. Dr. Hrdlička described pictographs of Northern Mexico that are suggestive of the Mayan hieroglyphs. Professor McGee reported the existence of curious pictographs which he had seen a few days before near the mouth of the Colorado River; on the top of a mesa covered with a thin layer of polished residual gravel huge figures had been traced by scraping away the gravel.

Dr. Ales Hrdlička presented the closing paper of the morning session, entitled, 'Albinos among the Hop a..d Zuñis.' A general outline of the nature of the phenomenon of albinism so far as it is known was given followed by a detailed account of the seventeen cases of albinism in the two pueblo tribes mentioned. Six of these cases are Zuñis. About two-thirds of the whole number are women. All are 'complete' albinos. Careful measurements show no inferiority in physical structure, and their slightly inferior strength is accounted for on the ground of lesser activity due to shyness. The eyes of these Indian albinos are invariably blue and not pink. No Hopi explanation of albinism was discovered. Dr. Fewkes stated that the Walpi Hopi had informed him that the people of the Middle Mesa, where the albinos are, make the 'White Paho,' prayer stick, and if a man whose wife is pregnant make such a Paho in an incorrect manner the child will be an albino. This Paho is not made at the First Mesa 'hence no albinos there.'

On Thursday afternoon Section H met with the American Folk-lore Society in the Donovan Room of McCoy Hall.

The session began with a paper by Dr. J. Walter Fewkes, entitled, 'An Interpretation of Pueblo Katcinas.' This paper embodied the results of a prolonged investigation into the character and significance of the many minor deities of the Hopi. This unique cult is regarded as a form of ancestor worship. Dr. Fewkes also exhibited a number of colored drawings that he had selected from a collection of 280 which the Hopi had made for him to illustrate the Katcinas. The value of these pictures is of course greatly enhanced by the fact that they are not only authentic, but the product of native talent.

Miss Alice C. Fletcher described 'The Lazy Man in Omaha Indian Lore.' The debate was graphically portrayed which the author once overheard in an Omaha camp, concerning the relative strenuousness of the life of the warrior of pre-Columbian days and that of the modern Indian. Their conclusion was that both must labor faithfully and continuously. From infancy the Omaha child is impressed with the direful consequences of laziness.

An interesting and valuable addition to the program was a paper upon 'The Treatment of an Ailing God,' by Dr. Washington Matthews. In the absence of the author, this paper was read by Dr. Hough.

'Hair in Folk-lore' was the subject of a paper by Mr. H. E. Warner, containing a summary of folk-sayings and tales regarding the human hair.

From the heirs of Dr. John Rae, a valuable manuscript has been received, entitled, 'Laieikawai, a Legend of the Hawaiian Islands.' This was written about thirty years ago. It was read in part by Mr. W. W. Newell. It is interesting because of the invention and dramatic power of the legend, as well as from the fact that it was written before the recent changes that tend to destroy the ancient myths.

Dr. E. W. Scripture reported that the American Philological Association and the Modern Language Association had each

appointed a committee of one to act upon a joint committee for collecting and preserving records of speech, song and similar material in various languages and dialects by means of speech-recording and transcribing apparatus. It was voted that Dr. Frank Russell be appointed to represent Section H upon this committee.

Frank Russell,
Secretary of Section H.

LELAND STANFORD JUNIOR UNIVERSITY.

We do not think that the time has yet come when a correct opinion can be expressed in regard to the unfortunate circumstances that have recently occurred at Leland Stanford Junior University. On the one hand, 'academic freedom' is absolutely essential as a condition of higher education and research; on the other hand, academic dignity and order must be maintained. At the present time we can only publish the letters exchanged between Professor Howard and President Jordan, and the subsequent letters by Professors Hudson and Little and the reply of acting-president Branner.

On January 10, 1901, President Jordan wrote as follows:

Professor George E. Howard, Stanford University—Dear Sir: After the dismissal of Professor Ross by the authorities of this university you took occasion to make certain remarks before your class criticizing the action and the motives of the management of the university. These remarks as reported in the newspapers and credited in university circles were, in the nature of the accusations, unjust, and, in the method of their presentation, discourteous to the university management. I have waited a reasonable time in the hope that reflection would enable you to see that some explanation and apology were desirable. Failing to hear from you I now deem it my duty to request you to make satisfactory apology for this breach of courtesy and to give such assurances of your attitude toward the management of the university as will guarantee a proper harmonious relation in the future. Failing in this it is my request that you at once tender your resignation, to take effect at the end of the current year, or sooner, should your feelings in the matter prevent harmonious cooperation until that time.

Professor Howard replied on the 12th:

President David S. Jordan, Stanford University—Dear Sir: In self-defense I am forced to reply to several charges and statements contained in your letter asking my resignation. On the day following the publication of Dr. Ross' dismissal by the authorities of the university I spoke to my class in French revolution on the subject of 'Commercial absolutism and the place of the teacher in the discussion of social questions.' The address was as earnest a protest against interference with academic freedom as I was capable of making. There was absolutely no discourteous reference to the president nor to the founder, although in the discussion of the general theme there was involved a strong disapproval of their action. I do not believe that any fair-minded person who heard me will say that my remarks were discourteous in the method of presentation or unjust in their content. In the address I referred to the motives and influences which have caused the restriction of free speech in various institutions of the country. But so far as the motives and influences governing the recent action were mentioned, directly or by implication, they were those assigned in the published statement of Dr. Ross and sustained by the substance of your conversation with me on the evening of the day on which that statement appeared.

I am obliged to refer to another passage in your letter. You will scarcely fail to recall the fact that since my address before the class in French revolution you have asked me to remain in the university and repeatedly said that you did not wish me to resign. On November 20th, when our last conversation regarding the Ross incident occurred, you said positively that you should not ask my resignation unless Mrs. Stanford demanded it. How then could you have been hoping for an apology?

I have no apology to offer. My conscience is clear in this matter. What I have said I have said, as I believe, in the cause of individual justice and academic liberty. Therefore, in response to your demand, I tender you my resignation to take effect at your pleasure. An immediate answer will oblige.

On the following day President Jordan wrote:

Professor George E. Howard, Stanford University—Dear Sir: Your letter of the 12th inst., tendering your resignation as professor of history in the Leland Stanford Junior University, is duly received. I accept your resignation, to take effect at a date to be determined by you, in accordance with the concluding words of my letter of the 9th inst. These words

are: "Failing this, I request you to tender your resignation, to take effect at the end of the current year, or sooner, should your feelings in the matter prevent harmonious cooperation until that time." I shall be glad to know your further wish in the matter, and it may be communicated to Vice-President Branner, who is acting president, with full powers, in my absence.

The correspondence closed with this letter from Professor Howard, dated January 14th:

President David S. Jordan, Stanford University, Cal.—Dear Sir: Your letter accepting my resignation is received. Of course I am well aware that the rights of the large number of students now registered in my classes are involved in fixing the time of my resignation. Therefore, since I am being dismissed from a life position on the alleged ground of discourtesy to the authorities of the university, it seemed to me but fair that you should take the responsibility of saying whether I should remain to the end of the year. You decline to take that responsibility, and so leave me but one safe and dignified course.

I should have been willing to remain to the close of the year for the sake of my students, could I have felt sure that by 'harmonious cooperation' you mean a faithful and free performance of academic duty according to the spirit of the original implied contract under which I have thus far labored. I have not changed my attitude toward the university or toward my professorial duties. I am only protesting against revolutionary proceedings. The vital point of the whole present incident is a question of free speech. Therefore I am not willing to pledge myself in advance to abide by the uncertain interpretation of the ambiguous phrase 'should your feelings in the matter prevent harmonious cooperation until that time.' Hence I wish my resignation to take effect at once.

On the following day Professors W. H. Hudson and C. L. Little presented their resignations. Professor Hudson's letter reads:

President Jordan—Dear Sir: For more than a year I have for personal reasons contemplated presently severing my connection with Stanford University. Recent events now precipitate my decision to do so.

As you are well aware I was from the first in strongest opposition to the new policy of the university inaugurated in the dismissal of Dr. Ross—a policy destructive of those first principles of academic freedom upon which, as you have repeatedly said, the university was originally founded. Ever since the occurrence of that incident I have seriously doubted whether it would be possible for me, consistently with my opinions, to retain my position in this faculty. But now that in further pursuance of such policy, you have seen fit to demand the resignation of a man whom you yourself, in common with all who have known him, have long regarded as one of our ablest scholars and noblest teachers, for no other reason than that furnished by his just condemnation of the action of the university authorities—now that, in this way, you have clearly shown that it is the intention of the university to inhibit fair criticism of its methods no less than frank discussion of public affairs, no doubt is left in my mind as to my course. Whatever plans I might otherwise have made I cannot under existing circumstances continue to hold my chair. I therefore tender you my resignation, to take effect at your pleasure.

Professor Little wrote:

President Jordan—Dear Sir: Ever since the dismissal of Dr. Ross, against your protest, for expressing in the discussion of public questions opinions displeasing to Mrs. Stanford, I have considered whether I, who hold similar opinions, could be willing to remain in the faculty of Stanford University. Your recent call for the resignation of a man whose ability and independence of character I have admired for twenty years, because he uttered, in a form courteous to you and to Mrs. Stanford, condemnation of a policy destructive of the academic freedom in which you profess to believe, put an instant end to my indecision.

I hereby resign my chair as professor of mathematics in Leland Stanford Jr. University, to take effect at your convenience.

To these letters Professor J. C. Branner, acting president, replied on the same day, in identical terms, as follows:

Professor William H. Hudson, Stanford University—Dear sir: Your resignation as Professor of English literature, in the Leland Stanford Junior University, addressed to President Jordan, has been handed to me as acting president.

Waiving the question of the validity of the reasons you put forward for your action, I hereby accept your resignation, to take immediate effect.

David E. Spencer, associate professor of history, has subsequently resigned.

SCIENTIFIC BOOKS.

Text-Book of Physiology. Edited by E. A. Schäfer, LL.D., F.R.S., Professor of Physiology, University of Edinburgh. Edinburgh and London, Young J. Pentland; New York, The Macmillan Co. Vol. II.

In the preface to the first volume, issued nearly two years ago, it is stated that 'the want of a text-book in the English language to which students could turn for information beyond that contained in the ordinary manuals has long been felt by teachers of physiology (in England). 'The most extensive of the existing text-books do not aim at giving the full and precise information, nor the references to original authorities which are required by the advanced student.' The object of the work, the second and final volume of which is now before us, is to supply this want. The object is an excellent one. But when we enquire how far the editor and his able collaborators have succeeded in their laudable aim, we feel bound to answer that the execution does not in all points correspond with the design. Not that the book is devoid of good qualities. In certain respects its merits are conspicuous. No text-book of physiology in the language is more accurate. None is so extensive in its scope. Few are so scientific in treatment. But as regards its avowed purpose it labors under a serious, if not a fatal, defect. The 'advanced student' for whom it is intended scarcely exists at present. The twentieth century, which, as the newspapers have assured us, holds so many wonders in its womb, may in the fullness of time produce from the strangely miscellaneous contents of that mysterious receptacle some such miracle of precocious learning. In this year of grace 1901, he is, we fear, almost as much an abstraction as Macaulay's omniscient schoolboy. We can hardly help thinking, indeed, that whatever may have been the original plan of the book, the editor has not always been able to prevent his contributors from running away from him, or the contributors their subjects from running away with them. The consequence is that while some of the authors have evidently had in mind as their model the exhaustive 'Handbuch' of Hermann, and have treated their respective themes with a wealth of illustrative detail and a copiousness of reference which leave little to be desired for the purposes of the professional physiologist, the contributions of others are such in contents and style as a student of actual flesh and blood, who had diligently improved his time in the physiological department of a medical school of actual brick and mortar, might hope to read with intelligence and profit.

We are far from supposing that a book on the lines of the 'Handbuch,' addressed to expert physiologists, is without value. On the contrary, we believe that if Professor Schäfer and his talented coadjutors, starting with the present work as a basis, expanding what is incomplete and retrenching what is too elementary, were to develop it into a really comprehensive treatise, and do for the physiology of the beginning of the twentieth century what Hermann and his fellow-workers did for the physiology of the early eighties of the nineteenth, they would confer a greater benefit on the cultivators of the science in all lands than a dozen Richet's Dictionaries will ever do. But in order that this may be accomplished, the impossible task of crowding into 2,200 pages a far greater volume of knowledge than Hermann twenty years ago was barely able to grapple with in more than 5,000 pages, would have to be frankly given up, and the idea of combining within the same boards a book for students and a book for experts once and for all abandoned.

When all due deduction is made for the discrepancy between plan and performance, it would be unjust not to say that the work remains by far the most notable recent attempt at a systematic exposition of physiology on a large scale in any language. Upon the whole, too, it cannot be denied that the authors, while avoiding hypercriticism in handling the experimental results of others, have escaped the still more serious error of making their articles mere compilations in which all the facts that have crept into the literature are spread before the reader without indication of their relative authenticity and importance. Occasionally, however, but so rarely as to excite surprise, it would seem that the Rhadamanthus of the blue pencil must have nodded over his long task.

For instance, on p. 454 the notion that 'the close agreement between the effect upon the functional changes (in nerve) of external CO_2, and of previous nerve activity, is an indication that CO_2 is produced during the active state,' is mentioned without any warning to the innocent student that this is a mere airy speculation, such stuff, in fact, as only dreams and Croonian lectures are made of. By the way, it seems rather a pity that in a book of this size the use of such inaccurate contractions as CO_2 for carbon dioxide should have been countenanced for the sake of a petty saving of space.

On p. 499, in the account given of the changes of conductivity produced in a nerve by the passage of electrical currents it is stated that the block is established during closure at the anode and after opening at the cathode. No mention is made of the well-known experiments of Hermann and others which demonstrate that the block at the cathode during closure of a voltaic current is relatively greater than at the anode, while after opening, this relation is reversed.

On 48, the statement is made that in Stolnikow's determination of the output of the heart on the 'simplified circulation,' the output was probably maximal on account of the low resistance to the outflow. It ought not to be left to the student to supply the criticism that the heart can not have been normally fed through the coronary arteries with a pressure of only 30 or 40 mm. of mercury in the aorta, and therefore probably was not beating with normal strength. On the same page a comparison of Zuntz's results on the output in the horse, obtained by a method theoretically perfect, with those of Tigerstedt in the rabbit, obtained by a method of dubious propriety, is concluded by the remark that when the output per second is expressed as a fraction of the body-weight the results of the two observers roughly agree. The reader would inevitably draw from this passage the inference that the accuracy of Tigerstedt's numbers is supported by this agreement. The exact opposite is the case. For it is well established that the output of the heart is much greater in proportion to the body-weight in small animals than in large. If, then, Zuntz's results are right for the horse, Tigerstedt's can not be right for the rabbit.

We are glad to see that Dr. Gaskell in his article on the contraction of the cardiac muscle, written in the interesting and almost autobiographical style so characteristic of this author when he handles this theme, has at last rid himself of the picturesque hypothesis that the positive electrical variation, observed by him in the quiescent auricle of the tortoise on stimulation of the vagus, indicates 'anabolic' changes in the muscular fibers, while the negative variation seen on stimulation of the augmentor nerves of the quiescent ventricle of the frog or toad indicates 'katabolic' changes, and has adopted the more prosaic view of other writers, that the electrical changes are simply associated with alterations in the tone of the heart muscle too small to be easily seen.

The contributors to this and the previous volume include most of the prominent workers in English physiology; and nearly all write upon subjects the knowledge of which they have advanced by their own labors. Thus, Dr. Leonard Hill, in one of the best articles in the book, treats of the circulation; Sir J. Burdon Sanderson, of striped muscle, including the electrical phenomena of this tissue, in the investigation of which he stands facile princeps in the English-speaking world; Professor Gotch, of nerve and electrical organ; Professors Schäfer and Sherrington, of the central nervous system; Dr. Langley, of the sympathetic and allied systems; Professor Haycraft, of animal mechanics, taste and smell; Professor McKendrick and Dr. Gray, of the ear and voice; Professor Starling, of the muscular and nervous mechanisms of the digestive tract, etc.; and Dr. Rivers, of vision.

G. N. I. S.

Die Lehre vom Skelet des Menschen, unter besonderer Berüchsichtigung entwickelungsgeschichtlicher und vergleichend-anatomischer Gesichtspunkte und der Erfordernisse des Anthropologischen Unterichtes an höheren Lehranstalten, bearbeitet. Von DR. F. FRENKEL, Professor am Königl. Gymnasium zu Göttingen. Mit 81 Textfiguren. Jena, Gustav Fischer. 1900.

We have given the title at length, cumbersome as it is, because it expresses the nature of the work, and because this book has the merit of being what it pretends to be. More than that, it is the successful working out of a well-considered and philosophical plan. The purpose, in short, is to offer to students a guide to the general principles governing the morphology of the human skeleton, considered according to development and comparative anatomy. The great beauty of the book is the subordination of details to principles. It does not teach the bones as they must be taught to a student of medicine, but we wish that all medical students could have been put through this book before the beginning of their medical studies.

With the bones are very properly considered both cartilages and ligaments. It is not the disjointed skeleton that is before us, but the real framework of the body. There is first a short chapter on the histology of bone and the other connective tissues involved, and then we begin the development of the skeleton from the *chorda dorsalis*. Then we have the shapes of bones, their connections, the development of joints and the various kinds. Then we come to the description of the particular parts of the skeleton with the scientific significance dwelt upon and the details suppressed. What a relief from the compendium of anatomy which thinks well of itself because it gives the several surfaces of the orbital process of the palate bone! On the other hand, to take one example of many, how interesting to have the comparative anatomy of the malar bone!

It is not necessary to discuss the book in further detail. There are many morphological questions concerning which different opinions may be held, and an author is not necessarily wrong even if the reviewer should not agree with him on all points. That the plan of the book is good and that the aim of the author has been true is praise enough. We will add, that we wish someone would 'do it into English.'

Thomas Dwight.
Harvard Medical School.

Evolution of the Thermometer, 1592–1743. By Henry Carrington Bolton. Easton, Pa., The Chemical Publishing Co. 1900. 98 pp.

This neatly printed and tastefully bound little monograph will be of interest to all physicists and chemists, and to the general public as well, for it deals with one of the most indispensable instruments in every laboratory, and one which, almost alone of those used by scientific men, has become an instrument of interest and use in every household.

In dispelling the fallacies and clearing away the obscurities which have enveloped the evolution of the thermometer, Dr. Bolton has again placed scientific men under an obligation, while at the same time he has afforded them an hour's entertaining reading.

The book opens by disposing of the oft-repeated claims that the inventor of the thermometer was Drebbel. The first use of the name, thermometer, and the first accurate description, comes from Leurechon in 1624, but the real inventor of the instrument was Galileo, and the date between 1592 and 1597. This is proved, not from any statements of the inventor, but from letters written to him, and the proof is complete. This first thermometer consisted of a bulbed tube, inverted in colored water, in which the liquid rose and fell with the temperature of the bulb. With such an instrument Sanctorius discovered that there was a normal body temperature. In 1632 Jean Rey made a water thermometer, in which the expansion of a fluid replaced that of air, and not long after this Ferdinand II. of Tuscany, by sealing the top of the tube, gave approximately the modern form to the instrument. Mercury had been previously used to show expansion by heat, but in 1714 Fahrenheit constructed the first mercury thermometer with a reliable scale.

Many different scales have at various times been applied to the thermometer, and in most of them the graduation has been almost purely arbitrary. The origin of the Fahrenheit scale is involved in much obscurity. Réaumur was the first to use the melting point of ice for zero, while his boiling point of water, 80°, was obtained by the expansion of one thousand parts of 80 per cent. alcohol between the freezing and boiling points of water. As this was eighty parts, he used this number for his higher fixed temperature. The first to adopt 0° and

100° for the two points was Celsius, but in his instrument 0° represented the boiling point of water. Finally the change to the modern centigrade scale was made independently by Christin of Lyons and Strömer of Upsala, in 1743. With this date, Dr. Bolton's story of the evolution of the thermometer ends.

At the close of the book is given a table of the relative values of thirty-five different scales which have been used at various times; a chronological epitome; a list of authorities, and an index to the book.

J. L. H.

BOOKS RECEIVED.

A Treatise on Elementary Dynamics. H. A. ROBERTS. New York and London, The Macmillan Company. 1900. Pp. xi + 258. $1.10.

An Introduction to Modern Scientific Chemistry. LASSAR-COHN. Translated by M. M. PATTISON MUIR. New York, D. Van Nostrand Company. 1901. Pp. viii + 348. $2.00.

The Foundations of Botany. JOSEPH Y. BERGEN. Boston, Ginn & Company. 1901. Pp. x + 412; v + 257.

SCIENTIFIC JOURNALS AND ARTICLES.

IN the November–December number of the *Journal of Geology* James Perrin Smith discusses the 'Principles of Paleontologic Correlation.' He lays great stress on interregional zones and concludes that correlations upon homotaxis and synchronism should not be very different. Under 'Contributions from Walker Museum' E. C. Case describes 'The Vertebrates from the Permian Bone Bed of Vermillion County, Illinois.' A forty-page article by C. R. Van Hise on 'Some Principles controlling the Deposition of Ores' discusses the concentration of ores by underground water. He urges a new and natural classification of these ore deposits based upon their genesis, believing that such a division would also be of the greatest importance in the practical problems of engineers.

THE contents of the *Journal of the Boston Society of the Medical Sciences* for December 4, 1900, are as follows: 'Demonstration of a Photomicrograph of the Bacillus of Soft Chancre,' by F. B. Mallory; 'The Etiology of the Chancroid,' by Abner Post; 'A Simple Method of cultivating Anaërobic Bacteria,' by James H. Wright; 'Occurrence of the Typhoid Bacillus in Suppurative Processes and in the Fœtus,' by Oscar Richardson, being the annotated record of a number of cases, and 'Observations on Milk Coagulation and Digestion,' by Franklin W. White.

The Plant World for December, 1900, opens with a popular article on 'Irises,' by F. H. Knowlton, in which he notes that there are about 160 species, and W. J. Beal presents, with illustrations, 'A Few Observations on Root Hairs'; Arthur Hollick gives 'An Example of Deductive Reasoning,' this being that the bottom deposits in a small swamp on Staten Island should represent the Quaternary age, a deduction that was verified by the excavation of the swamp. Edward Hale Brush gives some notes on 'Horticulture and Landscape Gardening at the [coming] Pan-American Exposition.'

The Auk for January contains two biographical sketches, 'In Memoriam: Elliott Coues,' by D. G. Eliot, and 'In Memoriam: George Burritt Sennett,' by J. A. Allen, both accompanied by portraits. Outram Bangs gives some observations on 'Birds of San Miguel Island, Panama,' incidentally describing four new species. James H. Fleming presents 'A List of the Birds of the Districts of Parry Sound and Muskoka, Ontario,' comprising 196 species, and E. W. Nelson gives 'Descriptions of Five New Birds from Mexico.' 'The Sequence of Moults and Plumages of the Laridæ' (Gulls and Terns) is discussed by Jonathan Dwight, Jr., a subject that has received little attention, save at the hands of Brehm, in 1854. John H. Sage, the secretary, has an abstract of the 'Eighteenth Congress of the American Ornithologists' Union.' The 'Report of the Committee on the Protection of North American Birds for the Year 1900,' by Witmer Stone, shows that while much has been accomplished, a great deal remains to be done, and that decided help may be hoped for from the recent 'Lacey Bill.' William Dutcher gives the 'Results of Special Protection to Gulls and Terns obtained Through the Thayer Fund,' the expenditure of $1,400 having resulted in the preservation of many birds.

Terrestrial Magnetism for September, which has just appeared, contains a portrait and biographical sketch of Professor Arthur Schuster. Among other articles in the number are 'The Present Status of our Knowledge of the Earth's Magnetism,' by A. Nippoldt; and 'Note sur une cause d'erreur dans la détermination de la déclinaison magnétique,' by H. Morize.

THE first number of the *Journal of Hygiene*, published by the Cambridge University Press and edited by George H. F. Nuttall, lecturer in bacteriology and preventive medicine in the University of Cambridge, late associate in hygiene in the Johns Hopkins University, Baltimore, is announced for immediate issue. The provisional table of contents is as follows:

'Introductory' by Sir John Simon, Professor William Osler and the Editor.

'Studies in Relation to Malaria.'

I. 'The Geographical Distribution of Anopheles in Relation to the Former Distribution of Ague in England,' by G. H. F. Nuttall, Louis Corbett and T. S. Pigg.

II. 'The Structure and Biology of Anopheles,' by G. H. F. Nuttall and Arthur E. Shipley.

'Pathogenic Microbes in Milk,' by E. Klein.

'Industrial Lead Poisoning,' by T. M. Legge.

'A Rapid Method of determining Carbonic Acid in Air,' by John Haldane.

'The Cause of the Red Color in Salted Meat,' by John Haldane.

'Artificial Modifications of Toxines, with Special Reference to Immunity,' by James Ritchie.

La euille des jeunes naturalistes, edited by Mr. Adrien Dollfus, 35 Rue Pierre-Charron, Paris, having existed thirty years, has taken the opportunity of improving its appearance and intends to concentrate its efforts mainly on the natural history of western and central Europe with the adjacent regions around the Mediterranean. The library at the disposal of subscribers to *La Feuille* now contains about 42,000 memoirs and 300 scientific journals. The November, December and January numbers, which are those that have as yet appeared of this new series, amply fulfill the promise made. The most notable article is 'Revision des espèces de Tritons du genre *Euproctus* Gené, suivi d'un aperçu des Urodèles de la région paléarctique du sud-ouest,' by Dr. W. Wottersdorff.

SOCIETIES AND ACADEMIES.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

A REGULAR meeting of the Section was held at 12 West 31st St., New York, on the evening of January 7, 1901. Professor Harold Jacoby, of Columbia University, gave an account of a 'New Telescope for Photographing the Pole of the Heavens.' He announced that this plan of photographing the close polar stars had made material progress. A special instrument has been constructed and mounted at the Observatory at Helsingfors, Finland. Photographs of the actual instrument in position for use were exhibited. It is planned to make photographs with this instrument in which the close polar stars will trace out 'trails' on the plate corresponding to their diurnal motion. The effects of refraction, etc., having been eliminated by computation, it is possible to obtain from such photographs the exact position of the celestial pole among the stars and on the date of observation. The intercomparison of results taken on dates six months apart should furnish a new determination of the constant of aberration, and photographs taken annually throughout a series of years should determine the constant of nutation and ultimately perhaps even that of precession.

The actual observing with the instrument will commence in the spring, as soon as the Helsingfors astronomers have finished with the observations of Eros now in progress, and the plates will be sent to Columbia University, New York, for measurements and reductions. An outline of the method to be used, together with a preliminary trial of the same, has already been published by Professor Jacoby, under the title 'Photographic Researches near the Pole of the Heavens,' *Bulletin of the Imperial Academy of Sciences of St. Petersburg*, 5th Series, Vol. 9, p. 41, June, 1898.

Mr. George B. Pegram, of Columbia University, read a paper on the 'Reflection of Light from White Surfaces.' This was an experimental study of some white surfaces with regard to the relation between the intensity of the reflected ray and the angles of incidence

and reflection. It was carried out by means of a special photometer, allowing the use of any desired angles of incidence and of reflection. Among the surfaces tested were plaster of Paris, several kinds of unglazed paper, compressed powders of several kinds, powders not compressed, but gently smoothed with a metal plate, and finally a surface made by allowing fine plaster dust to settle from suspension in the air on a suitable plate. These surfaces in the order named, showed decreasing polarization of the reflected light, and less approach to specular reflection. The fine dust surface showed no polarization, and almost no tendency to regular reflection. The results with this surface, as shown by sets of curves, follow pretty closely the old Lambert's, or cosine, law,

$$\text{Intensity} = A \cos i \cos r.$$

with some departure when both angles were very large. With all the other surfaces the departure was very great for angles greater than 70°. Contrary to the results of Mr. Wright (*Phil. Mag.*, Feb., 1900), these experiments were quite in accord with the demand of theory that the intensity of the reflected ray should be expressed as a symmetric function of the angles of incidence and reflection.

WILLIAM S. DAY,
Secretary.

CHEMICAL SOCIETY OF WASHINGTON.

THE regular meeting was held on December 13, 1900. The first paper was read by Dr. Bigelow and was entitled, 'The Composition of the Ash of Meat Extracts,' by W. D. Bigelow and E. McK. Chace. The relation between solids and ash and between the several ash constituents were discussed in analyses of about 40 commercial meat extracts and of juices prepared from fresh beef.

The second paper, read by Dr. Cameron, was entitled, 'Formation of Sodium Carbonate or Black Alkali by Plants,' by F. K. Cameron. The view popularly held, to which Hilgard, Goss and others have called attention, is found to be correct. It seems probable that the phenomenon is very widespread, but does not assume practical importance, except under special conditions in the arid regions. A discussion of the rôle of mineral nutrients in soil solutions accompanied the consideration of the data experimentally determined.

The last paper, read by Dr. Cameron, was entitled, 'Resistance by certain Plants to Black Alkali,' by F. K. Cameron. It has been found that a few plant specimens exist which can grow in soils containing much sodium carbonate. Three such plants were examined. It was found that these plants had an organic acid or acids formed on their surface, sufficiently strong to decompose alkaline carbonates. It is believed that this acid, or acids, aid in lowering the concentration of the alkaline carbonates in the soil immediately about the plants, and thus protect the root crowns from the caustic action of the black alkali.

WILLIAM H. KRUG,
Secretary.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 527th meeting was held January 5th, the new President, Mr. Walcott, Director of the Geological Survey, in the chair. The evening was devoted to geodetic papers.

Mr. Eimbeck presented informally the question of an apparent error arising in transit observations from the fact that at a locality where there is local attraction of the plumb line the geodetic meridian and the astronomical meridian differ sometimes as much as 30″.

The first regular paper was read by Mr. Isaac Winston on 'The Thirteenth General Conference of the International Geodetic Association,' held at Paris last fall, at which 17 countries were represented, and to which he was a delegate. The principal papers presented there dealt with recent work at gravity stations, the question of variation of latitude, the proposed revision of older triangulations in France and Peru, the nickel-steel alloy with small coefficient of expansion, and the recent and prospective measurements of terrestrial arcs. [This paper is printed above.]

Mr. Schott followed with an interesting historical account of such measurements, pointing out that the Clarke spheroid agreed better than Bessel's with the American observations. Mr. Hayford described more fully the simple new nadir-zenith apparatus of Cornu, to which ref-

erence had been made, the purpose of which is to determine the zenith distance of stars culminating very near the zenith.

The second regular paper was by Mr. Hayford on 'The New Precise Leveling Instrument' of the Coast and Geodetic Survey, with exhibition of it. The instrument is very low and stable, the new iron nickel alloy is used, the level tube is sunk well into the telescope tube, the parts are not reversible as formerly, and an auxiliary telescope with mirror is provided for the left eye to read the ends of the bubble. Field experience shows that both rapidity and accuracy of working have been much increased by the use of the new instrument. [The full description will be published elsewhere.]

Charles K. Wead,
Secretary.

DISCUSSION AND CORRESPONDENCE.

WHOSE FAULT AT THE U. S. NAVAL OBSERVATORY.

To the Editor of Science: It is natural and very proper that the Superintendent of the Naval Observatory should defend his institution, even vigorously, against charges, where he conceives there is ground for believing there has been lack of fair play. The delicate task imposed upon the Board of Visitors should evidently have been sufficient motive for safeguarding their report against the suspicion of unfairness, if any has been shown, by first giving full credit to the existing organization in preparation for their suggestions looking to an improvement. Otherwise, the entire affair will degenerate into a dispute, and that is the most hopeless basis upon which to approach Congress for remedial legislation.

Your editorial in Science of January 4, 1901, on the 'Naval Observatory Report' does not seem to be free from the objection that it charges against the administration of the Observatory certain results which do not in reality belong there. You blame it for the removal of the Magnetic Observatory to its present site, and for the imperfections of the instrumental apparatus acquired during the past thirty years. It is very easy to misplace responsibility, but in a discussion of this kind it ought not to be done; and the fact is admitted that in such matters of administration the executive acts upon the advice of his subordinates. Now, certainly, there could not be two more conspicuous examples chosen to show that, where the astronomers have had their own way, the blame is being shifted to the chief. For it is well known that the magnetic observatory was moved by the counsel of the Astronomical Director, in cooperation with that of a prominent visiting English astronomer, and against the arguments of the professor in charge of the magnetic work, and all others in Washington interested in magnetic observations. The action of neighboring trolleys and dynamos was pointed out, but the wish to possess the equipment overruled the interests of science. The fact that the work of the magnetic observatory has not been otherwise efficient is partly due to the appointment of untrained officers of the Navy to conduct the operations, and this is of course a matter of administration. In the planning of new instruments the astronomers have for a long while had their head, and if they chose to experiment in novel constructions and to entrust the building of the instruments to American firms, they ought at least to relieve the administration, which simply expressed their decisions, of the blame for an unsatisfactory outcome of that kind.

This brings up the problem of administration. There are two types of organization, the first, where there is a strong head and a corps of subordinates who are his assistants, and over whom his decisions are final, of which the observatories at Cordoba and Harvard College are examples; then there are staffs formed of practically independent professors whose real bond of union is cooperation, of which the Naval Observatory is an example; other observatories have a mixed system in operation. The first type is calculated to put out a large mass of routine work, and to do immense pieces of observation and reduction along well-understood simple lines; the second type is suited for scientific researches into unexplored territory, where the initiative and the successful progress depends entirely upon the personality of the astronomer. No chief by executive order can aid his research, and the heads of institutions are always only too glad to support the work of men

who show real capacity, and the persistency required to bring things to a conclusion. This type of organization is the one in keeping with the highest requirements of modern science, where a work is allotted by choice or natural selection to a man, and he is given the opportunity to develop it. If in such a body of men cooperating for a common good, there should enter jealousy, dissension and rivalry, the end will be defeated, but by no fault of the system. The astronomers of the United States should consider seriously whether it is wise to debase an organization which gives the utmost possible freedom to the individual astronomer, and supplant it with a scheme where authority at the top limits the scope of operations to the will of one man.

The executive in the large Government surveys is so far burdened down with administrative duties, finances, correspondence, mediation between Congress and the public, that it is quite impracticable for him to devote energy to the advanced problems of the day. A scientist can take up these duties only by abandoning his researches, and it is little more than a dream to suppose that one can carry both along together. The proper attitude is that of cooperation between the administrator and the astronomer engaged in practical research, and I am quite persuaded that the officers of the Navy, in the Bureau and at the Observatory, have been quite as faithful to their duties as the astronomers to their tasks. Lack of cooperation, from whatever cause it may arise, is not to be remedied by legislation; this may destroy the free chance to cooperate by introducing subordination, but it would be a step backward, and it should be taken only when a body of American astronomers can not be selected, who are willing to make the most of their splendid opportunities. Furthermore, the attachment of the Observatory to the Navy Department has been the source of its prosperity, in that it has thus secured liberal and generous congressional action through half a century. Now Congress has not yet felt that its duty lies in establishing and supporting an astronomical observatory for research only, no matter how valuable this might be to the world at large. Its theory is that a practical *quid pro quo* must be given for the people's money. The fact that the Navy needs a Nautical Almanac and a time service, and that these are practical utilities has been the ground for the annual appropriations. There is no other Department of the Government better fitted to press such claims upon Congress than the Navy, and to abandon this utilitarian ground would be to diminish the financial resources of the institution. As matters now stand there is no prospect of being able to persuade Congress to support such a research observatory; under the circumstances the nearest we can come to it is the free cooperation of the astronomers in the Naval Observatory. If these 'lay down' behind their commissions, or if their 'human nature' is too much for their good sense and the progress of science, there is no question where the responsibility should be placed. If it be true that the past generation at the Observatory, consisting of able, honorable men, failed to accomplish all they expected to do, may we not hope that the spirit of mutual cooperation between the executive and scientific staff, and the professors one with another, may still be the true remedy, rather than an angry discussion or any type of restrictive legislation which could be devised?

FRANK H. BIGELOW.

WASHINGTON, D. C., January, 10, 1901.

POTASSIUM NITRATE IN WYOMING.

LAST fall Mr. Victor Milward, of Dayton, Wyoming, sent me a small package of mineral which he wished tested for nitrates. The sample was a dark brown color, pulverent and contained a large amount of sand. Upon testing the substance I recognized that it was a nitrate and, in looking for the base, potassium was found in unusual quantities. Mr. McClelland an instructor in this department made a preliminary analysis and found that the sample contained upwards of fifty per cent. of potassium nitrate, and that it was nearly pure. Sodium was not detected. Mr. Milward was informed of his discovery and encouraged in making further investigations, and also asked to furnish some data as to his discovery and its extent. Later a number of samples of dark colored sandstone were received, that had been taken from

various depths and also a specimen from the surface of the prospect. The samples did not contain any of the salt except the one taken from the very surface. On this the nitrate was a coating about a quarter of an inch in thickness, and, as the previous sample sent, was approximately pure potassium nitrate. So far, the salt found is in very limited quantities and there are no explanations to offer for its existence or accumulation. It is evident that it has been brought in and deposited upon the sandstone but the source has not been detected. Owing to the winter months being close at hand when the discovery was made, it was not possible to carry on any extended examination. Potassium nitrate has been found in very minute quantities in the Leucite hills by Cross; this, however, is the most important discovery ever made in the State, and may result in the location of nitrate deposits of commercial importance.

Wilbur C. Knight.

Geological Laboratory,
University of Wyoming,
Jan. 16, 1901.

CURRENT NOTES ON PHYSIOGRAPHY.

SOUTHERN WISCONSIN.

'The Geography of the Region about Devil's Lake and the Dalles of the Wisconsin' by R. D. Salisbury and W. W. Atwood (*Wis. Geol. and Nat. Hist. Survey*, Bull. v, Educational series, 1, Madison, 1900), is a significant publication if for no other reason than that it is concerned with geographical features and that it is a State publication 'primarily designed for use in the schools.' State surveys have been very slow in coming to recognize their responsibility in this direction; and we are glad to see Wisconsin now following Missouri, New Jersey and Maryland. The region described includes a typical resurrected mountain, Baraboo ridge, of Huronian quartzite, adjoined by a plain of erosion, too smooth over much of its extent to be called a peneplain, formed by the removal of paleozoic strata which once buried the ridge, and which still remain in isolated castle-like hills here and there over the plain, and more continuously in hilly uplands farther southwest. The Dalles of the Wisconsin river are cut in the plain where the river has been displaced by glacial action from its former course. The 150 pages of the report are illustrated by 38 plates and 47 figures, and closed with a good index.

THE ISLANDS OF SOUTHERN CALIFORNIA.

'A Topographic Study of the Islands of Southern California,' by W. S. Tangier Smith (Bull. Dept. Geol., Univ. Cala., ii, 1900, 179–230) presents additional details concerning the features of this interesting group. The author points out that on a single shore line a wave-cut terrace of much strength may be developed where the coast has a moderate resistance and gentle slope, while hardly any shore marking is made where the coast is more resistant and of steeper slope. On San Clemente the rocks are relatively resistant and the general slope of the island is moderate; here wave-cut terraces at various levels have been remarkably developed and wonderfully preserved.

The occurrence of such terraces suggests some observations regarding the origin of those plains of erosion which now stand somewhat above sea level and are moderately dissected by streams, as in the Piedmont district of eastern Virginia and in the peninsula of Brittany. On both these plains the broad uplands are sheeted over with heavy soils of local weathering; the valleys that dissect the uplands are narrow and steep-sided. If the plains were of subaërial origin the abundant soils would be an appropriate feature; if the plains were the result of marine abrasion, the soils must have been developed by weathering on the wave-cut rock floor in the same period of time as that required for the erosion of the narrow valleys. The terraces of San Clemente may perhaps afford means of comparing the rate of soil production and valley erosion, and thus of giving further evidence regarding the origin of the districts in question.

DEECKE'S ITALIEN.

A work on the general geography of a country should not be criticised too closely with regard to its physiographic chapters, for there are many other lines toward which the chief interest of the author may have been drawn more strongly. It is nevertheless instructive to examine the method of treating land forms

that is found acceptable in an important volume of a new series of geographical handbooks. Deecke's work on Italy * treats in its first chapter the limits and area of the country; in the second, the surrounding seas; in the third, the history of exploration; relief in the fourth, geological structure in the fifth, and climate and hydrography in the sixth and seventh. Then after 250 pages devoted to population, history, products and commerce, government and religion, the remaining 125 are given to the description of provinces ('Chorography'). In comment on this order, it may be said that it is not satisfactory from a physiographic standpoint to give a leading place to relief and a following place to geological structure; in such an order, relief must be treated empirically and to that extent imperfectly. Under hydrography many interesting details are given concerning certain rivers which have changed their courses in historical time—the Adige, the lower Po, and the Chiana between Tiber and Arno—but the development of rivers is hardly considered. The provincial descriptions include much material of value, yet they omit many facts that would shed useful light on local topography. Taken all together, the book is certainly good, but it does not contribute much to the development of the new scheme of geographical treatment that it is to be hoped may characterize similar works in the new century.

NORWAY.

A HANDSOME volume entitled 'Norway, official publication for the Paris exhibition, 1900' (Kristiana, 1900, 626 + xxxiv p., many plates, figures and maps) contains valuable chapters on topography, by Hansen; geology, by Reusch; and climate, by Steen, occupying 50 pages; the rest of the volume being given to history, social conditions, commerce, etc. Hansen gives a just emphasis to normal and glacial erosion in his account of surface features. The highland is described as an immense mountain plateau, whose 'even summits clearly indicate that it was originally a plain of denudation that has afterwards been forced up into an arch.' The summits that tower above it, being of harder rocks, may be supposed to have withstood the destructive forces which leveled the remainder. 'Actual connected mountain chains rising above lowlands at both sides do not exist.' Canyon like valleys, cut in the uplifted highland, were modified by strong glacial erosion, producing fiords. The mountains that rise above the highland frequently have sharp alpine forms with corries (botner) which are described as having been developed in névé fields above level of the glacial sheet. The glaciated area exposes bare rock over so much of its surface as stands above the old shore line that marks post-glacial submergence; but below this line there are abundant sands and clays, affording arable land. The population is largely found below this level.

The relation of Norway to Sweden is interestingly presented. Although the two countries border each other along a boundary line that measures a thousand miles in length, by far the greatest part of this line lies on the uninhabited mountainous highland. The two countries are therefore separated rather than joined. Only three railroads and about a dozen highways cross the boundary. In 1898, only five per cent. of Norway's goods-exchange crossed the land frontier by railway and only one third of one per cent. by other means, while ninety-five per cent. went by sea.

WM. DAVIS.

* 'Bibliothek der Länderkunde' herausgegeben von Dr. A. Kirchoff und Dr. R. Fitzner. Berlin, Schall. 'Italien' von Professor Dr. W. Deecke, 1898.

UNITED STATES BOARD ON GEOGRAPHIC NAMES.

THIS Board, to which is referred questions of disputed geographic nomenclature arising in the Executive Departments of the Government, held its monthly meeting January 9th. Philippine Island names were considered at some length. The Coast and Geodetic Survey is about to issue an atlas of the Philippine Islands. This atlas will contain about thirty maps made by Jesuit missionaries in the islands. It is preceded by an introduction, which, among other things, has three lists, comprising in all about 6,000 geographic names. These names are now in the final proof stage. The list was prepared and the proof corrected by Rev. Father Algue, S.J., of Manila, but who has been

spending the winter in Washington. The Coast and Geodetic Survey asked the Board to adopt this list of names. The United States Hydrographic Office had previously submitted a manuscript list of about 4,000 coastwise names which list had been compiled in that office and asked for its adoption by the Board. To that request the Board had responded by recommending that it be submitted to Father Algue for comment, correction and criticism. This list with Father Algue's criticisms, together with the Coast and Geodetic Survey list was presented and discussed and, as the outcome, both lists were referred to the Hydrographic Office for comparison with a view to discovering cases of discrepancy.

The Board proceeded with its usual routine cases, deciding 21 of them. Most of these are minor features in different parts of the country, and thus of only local interest. For example, whether it is Bobs or Bobbs, Douglas or Douglass, Mullin or Mullen, Reem or Reams, etc. Such cases are for the most part easily disposed of by getting, by correspondence, local information.

Two or three cases were of wider interest. For a county in Idaho the Board adopts the form Nez Perce (not Nez Perces) conformably to the uniform practise in that county and in Idaho. For a river in southwestern Iowa the form Nishnabotna was adopted in place of several other forms which have been more or less used. For three glaciers in Glacier Bay, Alaska, were adopted the names Carroll (not Woods), Grand Pacific (not Johns Hopkins), and Rendu (not Charpentier). All these names, including the rejected forms, are still in use, but there has been confusion in their application. The Board follows the original usage as printed on Coast and Geodetic Survey map No. 3,095 (edition of July, 1899).

Finally, one more case in Alaska may be mentioned. The easternmost point of Kadiak is supposed to be the one seen by Bering in 1741 and by him called St. Hermogenes; on some charts written Hermogenes. Cook in 1778 called it Greville. Some of the Russian charts call it Yelovoi (spruce) and others Tolstoi (broad). Its supposed native name is Chiniak, which on one chart has appeared as Tuniak. The present local usage is reported to be Chiniak and this was adopted by the Board.

SCIENTIFIC NOTES AND NEWS.

The Geological Society of London has made the following awards for 1900: Wollaston medal, Dr. C. Barrois, Secretary of the International Geological Congress. Wollaston fund, Dr. A. W. Rowe, for papers on zonal geology and paleontology of the chalk of England; Bigsby medal, G. W. Lamplugh, of the British Geological Survey. Murchison medal to A. J. Jukes-Browne, of the same. Murchison fund, to T. S. Hall, of Melbourne, for work on the Tertiary Geology of Victoria. Lyell medal to Dr. R. H. Traquair, pal-ichthyologist of Edinburgh. Lyell fund to be divided between Dr. J. W. Evans, for work on Indian geology, and A. McHenry, of the Geological Survey of Ireland.

William H. Crocker, of San Francisco, has offered to defray the expenses of a solar eclipse expedition to be sent by the University of California from the Lick observatory to Sumatra to observe the total eclipse of the sun on May 17th. An astronomer and assistants will sail from San Francisco on February 19th to be absent until July. They will establish an observatory camp somewhere within twenty miles of Padang, on the west coast of Sumatra.

At the recent International Congress of Hygiene and Demography a committee was appointed on the hygiene of streets, of which Dr. R. Hering of New York is the American member.

Among the honors conferred by Queen Victoria for the New Year are the K.C.B. on Sir William Turner, professor of anatomy in the University of Edinburgh, and baronetcies on Dr. William Church, president of the Royal College of Physicians, and Dr. Thomas Barlow, a London physician.

Professor E. von Drygalski, of the University of Berlin, has been elected an honorary corresponding member of the Royal Geographical Society of London.

The Spencer Lens Company, Buffalo, N. Y., of which Dr. Roswell Park is president, announces that it has placed its scientific

department in charge of Dr. Hermann Kellner, who has been associated with Professor Abbe in the optical works of Carl Zeiss at Jena. Mr. Carl F. Dieckmann, who has also been employed at the Zeiss optical works, has been engaged as superintendent.

DR. BUSHROD W. JAMES, of Philadelphia, has been elected president of the Pennsylvania Fish Protective Association.

MR. G. T. HASTINGS, who was last year assistant in botany in Cornell University, is this year teacher of science in the English Institute, Santiago, Chili. Mr. Hastings's engagement is for five years, and during that time he expects to make a thorough study of the flora of the region.

DR. VICTOR C. VAUGHAN, professor of hygiene in the University of Michigan, has been appointed to a third term as member of the Michigan State Board of Health.

PROFESSOR E. F. BUCHNER, of the department of psychology of New York University, has been elected an honorary member of the new French Société Libre pour l'Étude Psychologique de l'Enfant, of which Professor F. Buisson, of the Sorbonne, is president.

THE Science Club of Northwestern University held its last meeting on the evening of January 11th. The Club was addressed by Professor A. V. E. Young on 'A Century of Discovery among the Elements.'

PROFESSOR WILLIAM HALLOCK, of Columbia University, gave on January 22d the second address before the Washington Academy of Sciences on the 'Progress and Tendency of Science during the Nineteenth Century,' his subject being physics.

DR. DAVID T. DAY, of the United States Geological Survey, is giving a series of Columbia University lectures at the American Museum of Natural History on Saturday evenings, as follows: January 5th, 'The Mining Outlook of the Opening Century'; January 12th, 'The World's Mineral Wealth as shown at the Paris Exposition'; January 19th, 'The Petroleum Industry of the United States'; January 26th, 'The Mineral Resources of Cuba, Porto Rico, Hawaii and the Philippines.'

THE Friday evening meetings of the Royal Institution of Great Britain opened on January 18, 1901, when Professor Dewar was expected to give a lecture on 'Gases at the Beginning and End of the Century.'

DR. HARTINGTON, who has been relieved from the position of head of the medical department of the University of West Virginia by the Board of Regents, has brought suit to recover $25,000 from the president of the University.

THE death is announced of M. Charles Hermite, the eminent French mathematician, at the age of seventy-eight years.

THE death is also announced at the age of seventy-five years of Dr. Potain, professor of medicine at various institutions in Paris since 1876, member of the Academy of Medicine since 1882, and of the Academy of Sciences since 1894.

THE position of hydrographic draughtsman in the U. S. Coast and Geodetic Survey, at a salary of $600 per annum, will be filled by Civil Service examination on February 5th and 6th.

WE are requested to state that a young Russian gentleman, now living at St. Petersburg, who has done excellent work in physics and bacteriology, desires to find a position in the United States in the field of physiology or the applications of physics. Those interested in this matter will do well to correspond directly with His Excellency, Dr. H. Wild, 56 Englisch Viertel-Str., Zurich, Switzerland, or with Professor Cleveland Abbe, Washington, D. C.

THE Carmichael prize of the Royal College of Surgeons in Ireland, which is of the value of £120, has been awarded to Mr. H. Nelson Hardy, F.R.C.S.Ed. for an essay dealing with the state of medicine, surgery and pharmacy in the United Kingdom.

THE Astley Cooper triennial prize of £300 will be awarded by Guy's Hospital, London, for an essay on 'The Pathology of Carcinoma and the Distribution and Frequency of the Secondary Deposits corresponding to the Various Primary Growths.' The essays should be sent to Guy's Hospital on or before January 1, 1904.

THE New York Zoological Society has presented the American Museum of Natural History with the following specimens: A young

moose (*Alces americanus*), an equine deer (*Cervus equinus*), an orang utang (*Simia satyrus*), a loris (*Nycticebus tardigradus*), an ocelot (*Felis pardalis*), three bay lynxes (*Lynx ruffus*), a jaguarondi (*Felis jaguarondi*), two black leopards (*Felis pardus*), a raccoon (*Procyon lotor*).

At the 526th meeting of the Philosophical Society of Washington, held December 22, 1900, in the assembly room of the Cosmos Club, the following officers were elected for the calendar year 1901: *President*, C. D. Walcott, Geological Survey; *Vice-Presidents*, R. Rathbun, Smithsonian Institution; J. H. Gore, Columbian University; C. Adler, Smithsonian Institution; E. D. Preston, Coast Survey; *Treasurer*, B. R. Green, Library of Congress; *Secretaries*, J. F. Hayford, Coast Survey; C. K. Wead, Patent Office; *General Committee*, W. A. DeCaindry, War Department; G. W. Littlehales, Hydrographic Office; H. M. Paul, Navy Department; F. W. True, National Museum; I. Winston, Coast Survey; J. E. Watkins, National Museum; J. G. Hagen, Georgetown Observatory; C. F. Marvin, Weather Bureau; L. A. Bauer, Coast Survey.

At the annual meeting of the Anthropological Society of Washington, on January 8th, the following officers were elected: *President*, W. H. Holmes; *General Secretary*, Hannah L. Bartlett; *Treasurer*, Perry B. Pierce; *Curator*, Mariana P. Seaman; *Councilors-at-large*, Alice C. Fletcher, J. Walter Fewkes, and J. D. McGuire. At the ensuing meeting of the Board of Managers the councilors were increased by the election of Weston Flint, F. W. Hodge, Walter Hough, George M. Kober, D. S. Lamb, John H. McCormick, Edith C. Westcott and Thomas Wilson; and the organization was completed by selecting Walter Hough as Secretary to the Board, and designating the vice-presidencies as follows: Somatology, D. S. Lamb; psychology, Frank Baker; esthetology, W J McGee; technology, J. Walter Fewkes; sociology, George M. Kober; philology, J. W. Powell; sophiology, Alice C. Fletcher.

At the annual meeting of the Columbia Historical Society, held on January 7, 1901, officers for the ensuing year were elected as follows: *President*, John A. Kasson; *First Vice-President*, Ainsworth R. Spofford; *Second Vice-President*, A. B. Hagner; *Treasurer*, J. Dudley Morgan; *Recording Secretary*, Mary Stevens Beall; *Corresponding Secretary*, M. I. Weller; *Curator*, James F. Hood; *Chronicler*, William B. Bryan; *Managers* (for term expiring in 1905), Lewis J. Davis and J. Ormond Wilson.

It will be remembered that at the fourth International Zoological Congress, held at Cambridge in 1898, it was decided that the fifth Congress, in 1901, should be held in Germany. Announcement has now been made, says *Nature*, that the meeting place will be Berlin, on August 12–16, and the president, Professor K. Moebius, director of the zoological collection of the Natural History Museum, with Professor F. E. Schulze, director of the Zoological Institute, as vice-president. The secretaries of the Congress will be Herr P. Matschie, Dr. M. Meissner and Dr. R. Hartmeyer. The treasurers will be Herr H. Schalow and Herr Otto Stutzbach. Arrangements as to meetings and papers will be in charge of Professor L. H. Plate; apartments and receptions will be under the care of Dr. L. Heck, and the lighter pleasures of the meeting will be managed by Dr. O. Jaekel. The meetings will be held in the Natural History Museum and neighboring rooms of the University. Among the subjects to be brought before the Congress are the following: 'Fossil Remains of Man,' Professor Branco (Berlin); 'Vitalism and Mechanism,' Professor Bütschli (Heidelberg); 'Theories of Fertilization,' Professor Yves Delage (Paris); 'The Psychological Attributes of Ants,' Professor A. Forel (Morges); 'The Malarial Problem from a Zoological Point of View,' Professor Grassi (Rome); 'Mimicry and Natural Selection,' Professor E. B. Poulton (Oxford). After the conclusion of the Congress an excursion will be made to Hamburg for the purpose of visiting the Natural History Museum and Zoological Garden there, and also to Heligoland. Communications concerning the Congress should be made to the president, 43, Invalidenstrasse, Berlin, N. 4. Admission to the Congress will be free to all zoologists and all friends of zoology.

It is stated in *Terrestrial Magnetism* that the Magnetic Observatory at Cheltenham, Mary-

land, near Washington, D. C., which is to form the principal base station of the magnetic survey of the United States, is now ready for the installation of the instruments. The buildings were constructed under the superintendency of Mr. J. A. Fleming, of the Coast and Geodetic Survey, who also drew up the plans. Dr. W. G. Cady, a graduate of Brown University, and of the University of Berlin, and a member of the Division of Terrestrial Magnetism during the past six months, will have principal charge of the observational work. It is the intention to carry out at this observatory magnetic, meteorological, seismological, atmospheric-electric, and earth current observations.

AT the meeting of the New York Zoological Society on January 15th the following officers were reelected: *President*, Levi P. Morton; *Executive Committee*, Levi P. Morton, *ex-officio;* Henry F. Osborn, chairman; John L. Cadwalader, counsel; Charles T. Barney, John S. Barnes, Philip Schuyler, Madison Grant and William White Niles. The report of the Executive Committee sets forth the necessity for an increase of annual membership to 3,000. The income is now $7,900 annually, and what is needed is an income of $30,000 annually. The report speaks of the increasing attendance, and says that with the additional increase from rapid transit the walks, paths and buildings will be taxed to their utmost. The total attendance for the year was 325,925. Regarding the funds appropriated by the city for maintenance of the park, the report has this to say: "For two years there has been a deficiency in maintenance, owing to no lack of good will on the part of the city authorities, but a failure to appreciate the needs of the Park. In 1899 the City contributed $30,000 and the Society contributed $7,038.61 towards the maintenance of the Park. In 1900 the maintenance fund of $40,000 again resulted in a serious deficiency, which has been met by the Society by a contribution of $6,524.04. The Society estimated $80,000 as the fund needed for 1901, in order to meet the increased demand for food and additional keepers; the fund assigned is $65,000. We trust that this fund will enable the committee by the greatest economy to maintain the Park on its present limited scale without a serious deficiency.

MR. CARNEGIE has offered to build at Syracuse a library for $200,000. The city will provide a site and $30,000 for maintenance.

THE new building for the Boston Medical Library was formally opened on January 12th. The speakers announced on the program were: Dr. Francis W. Draper, president of the Massachusetts Medical Society; Dr. William Osler, professor of medicine in Johns Hopkins University; Dr. John S. Billings, librarian of the New York Public Library; Dr. Horatio C. Wood, of the University of Pennsylvania, and Dr. Henry P. Walcott, acting president of Harvard University. The new building, which is on the Fenway, is of stone and brick, and contains ample accommodation for the library of 32,000 volumes, together with rooms for lectures and meetings.

THE Swiss Parliament has voted a permanent subsidy to the Concillium Bibliographicum, which assures the continuation of the work inaugurated and carried forward with so much energy by Dr. H. H. Field. The vote was passed without opposition in the lower house and nearly unanimously in the upper house.

THE executive board of the Association for maintaining the American Women's Table at the Zoological Station at Naples and for promoting Scientific Research by Women announces that, in addition to maintaining a table at Naples, it is able to offer for the season 1901 the free use of a table at the Marine Biological Laboratory at Wood's Holl. The appointments are made by the executive board, with the cooperation of a regularly appointed board of advisors, on whose judgment the executive committee relies for decision in questions relating to the scholarship of candidates based on the results of work presented for examination. The members of the present board of advisors are Professor Ethan A. Andrews, of Johns Hopkins University, Professor R. H. Chittenden, of Yale University, and Dr. W. T. Porter, of the Harvard Medical School. The year of the Association begins in April, and all applications for the year 1901, both for the table at Naples and for that at Wood's Holl,

should be sent, on or before March 1, 1901, to the secretary, Miss Florence M. Cushing, 8 Walnut street, Boston, Mass.

As we have already announced the same Association has offered a prize of one thousand dollars for the best thesis presented by a woman, on a scientific subject, embodying the results of her independent laboratory research in any part of the field covered by the biological, chemical and physical sciences. The board of examiners for the prize is as follows:

Biological Sciences: Dr. William H. Howell, Johns Hopkins Medical School; Dr. William Trelease, Washington University; Dr. Charles O. Whitman, University of Chicago; Dr. Edmund B. Wilson, Columbia University.

Chemical Sciences: Dr. Russell H. Chittenden, Yale University; Dr. John U. Nef, University of Chicago; Dr. Ira Remsen, Johns Hopkins University: Dr. Theodore W. Richards, Harvard University.

Physical Sciences: Dr. Carl Barus, Brown University; Dr. Albert A. Michelson, University of Chicago; Dr. Edward W. Morley, Western Reserve University; Dr. Arthur G. Webster, Clark University.

The International Mining Congress will meet at Boise, Idaho, in July of the present year.

According to a recent bulletin of the Census Bureau, the center of population of the United States is now latitude 39.9.36; longitude, 85.-48.54, having moved westward about fourteen miles and southward about three miles since the last census.

The *British Medical Journal* states that Professor Claudio Fermi and Dr. Tonsini, of Sassari, have recently reported the results of experiments in the prophylaxis of malaria made by them in the island of Asinara, off the northwest coast of Sardinia. They succeeded in destroying the *Anopheles* larvæ by means of petroleum poured into the pools of the island. This was repeated twice a month. The process was begun in June and continued until the end of November. The mosquitoes in the air were destroyed inside houses by means of a mixture of powdered pyrethrum, chrysanthemum, valerian, etc., and the *zanzolina* of Celli and Casagrandi. In the dormitories of prisons, when there was nothing better available, chlorine, generated by treating calcium chloride with sulphuric acid, was employed. Protective nettings were applied to windows. The result was that hardly any *Anopheles* were found in any dwelling, while *Culex pipiens* was much scarcer than in former years. Not a single case of primary malaria was observed.

The Wisconsin Geological and Natural History Survey has in press two bulletins of its economic series. One of these is the first part of a report on the clays and clay industries of the State and is by Dr. E. R. Buckley, assistant superintendent of the Survey. The other, written by Professor U. S. Grant of Northwestern University, deals with the copper-bearing rocks of the northern part of the State. It is expected that these bulletins will be issued in January, 1901.

We quote the following editorial note from *Nature*: "A few weeks ago the new anthropological collections in the American Museum of Natural History in New York were opened to the public, and these valuable collections now occupy five halls, and others are being provided. We learn from our contemporary, Science, that the accessions to the anthropological collections of the museum obtained during the last three years have largely been due to extended scientific research undertaken by the institution. In this respect the methods of the American Museum of Natural History differ considerably from those pursued by a number of other institutions. It has not been the policy of the museum to accumulate rapidly and indiscriminately more or less valuable specimens collected on trading expeditions or purchased from dealers; but an endeavor has been made to build up representative collections and to obtain at the same time the fullest and most detailed information in regard to specimens, so that each addition to the exhibit of the museum can be made thoroughly instructive and will represent a material contribution to science. There is no doubt this is the best way to build up a museum, and it is to be deplored that the various museums of the British Islands do not follow the example so worthily set by this and other American museums. Our English method is rather to wait like a spider in its web in the hope that something will eventually be caught;

in the meanwhile, other institutions are intelligently collecting wholesale in diverse interesting regions, while we are content with occasional specimens which usually have no history, or at most a very imperfect one, and for these we often have to pay a stiff profit to a dealer."

THE New York *Times* lays stress on its announcement that the newspaper contains 'all the news that's fit to print.' Does the editor regard the following, taken from a recent issue as 'fit to print'?

"James Conroy, of 127 Hopkins Avenue, Jersey City, claims to have devised a system of springs and weights, which, operating as a balance, will run machinery without the aid of fuel, electricity, or any other motive power. The system is so simple, he says, that the only wonder about it is that it was never discovered before. It may be operated, he says, by a boy. While it is not perpetual motion, he says it will run until one of the springs or some other part of the arrangement breaks, but that will only mean a cessation of movement until a new part is substituted for that which is broken. He will not exhibit his machinery, but says he has demonstrated its power by operating a pump in his house. All he will say is that the power is furnished according to a decimal system making ten pounds the unit of weight. This unit may be increased by multiples of ten until the desired power for any machine is attained. He says he can easily satisfy any engineer of the validity of his claims. Another thing Mr. Conroy claims is that should any part of the machinery break the machine will not be wholly disabled, but will continue to run with a power diminished only by the broken part, which will be one-tenth, the diminution continuing in that ratio for each broken part."

THE Calcutta correspondent of the London *Times* cables that since the Pasteur Institute was opened at Kasauli about 100 patients bitten by mad dogs have been treated, among whom not a single death has occurred. Appeals for funds from the municipalities, however, have been rejected. Native opinion, especially among the Hindus, joins the Buddhists in pronouncing against the Institute owing to a mistaken idea that cruel operations are practised upon living dumb animals. Memorials have been submitted to the Government protesting against State aid, though this is only given to enable British soldiers to be treated in India instead of proceeding to Paris, thus saving a large sum annually. Bishop Welldon, preaching in the cathedral, referred to the opposition to the Institute in England and India. He said he had visited Kasauli and seen the operations, and stated that the medical process was characterized in all its aspects by the most thoughtful and scrupulous humanity. Anæsthetics were employed, and the animals showed no visible sign of suffering, dying eventually, not of hydrophobia, but of paralysis. He urged people to be slow to condemn a remedial process which, at the cost of a slight infliction of pain on animals, relieved and removed suffering so intense as hydrophobia in the case of human beings.

THE report of the Meteorological Council of the Royal Society for the year ended March 31, 1900, has been issued. The work of the council is summarized under the heads of ocean meteorology, weather telegraphy and climatology. The inquiry relative to the unusually severe weather which prevailed in the Atlantic during the winter 1898–99 has been completed, and the charts illustrating the results of the investigations will be ready for publication shortly. A table is given comparing the forecasts for the United Kingdom with the subsequent weather actually experienced. The complete success, partial success, partial failure and complete failure of the forecasts are estimated according to definite rules. Partial success and partial failure are defined as meaning that the forecast was correct or incorrect for more than half the elements dealt with at the places of observation situated in the district in question. This table, when summarized, gives 55 per cent. of complete successes, 27 per cent. of partial successes, 12 per cent. of partial failures and 6 per cent. of complete failures.

UNIVERSITY AND EDUCATIONAL NEWS.

THE following large gifts for education have been made during the week: John D. Archbold of New York City, a vice-president of the Standard Oil Company, has given $400,000 to the endowment fund of Syracuse University, on the condition that a like amount be raised among other friends of the institution; Mr. Andrew Carnegie has given $225,000 to the

Upper Iowa University, at Fayette, Ia., to be used preferably for a library, and $50,000 to Aurora College, an Illinois institution; Augustana College at Rock Island, Ill., has received about $30,000 from Messrs. E. C. and J. A. Ericsson, of Boone, Ia.; Mr. John D. Rockefeller has offered to give $15,000 to Carson and Newman College, a Baptist institution in Tennessee, provided $50,000 in addition be raised; Carleton College, at Northfield, Minn., has added $150,000 to its permanent endowment fund, $50,000 being the gift of Dr. D. K. Pearsons, and the remaining $100,000 being raised from various sources.

Gifts to educational institutions in Great Britain include the following: Mr. Charles W. Mitchell, £20,000 to the University of Aberdeen to pay the debt of the University; Lord Durham, £1,000 towards the building fund of the Durham College of Science, and the Misses Mercer, £1,000 to establish a scholarship, or scholarships, in chemistry at the Blackburn Technical School in memory of the late Mr. John Mercer, the discoverer of the process of Mercerized yarn.

The registration at Harvard University, as recorded in the issue of December 21st last of this journal, appears to need correction. Professor Storer calls our attention to the fact that the figures for the Bussey Institute and for the veterinary school were not included. These should be 33 and 18 respectively. On the other hand, the registration of the Medical School is too large. Dean Richardson, of the Medical School has explained the matter as follows: "Mr. Cram must have misunderstood your question and gave you the number enrolled, which at that time was 600, and added to it the number which were enrolled in the summer courses, 149, making a total of 749."

The President of the Board of Education, London, has appointed a committee, consisting of Sir William de W. Abney, K.C.B., F.R.S. (Chairman), Sir Philip Magnus, Sir Swire Smith, Mr. G. R. Redgrave, Mr. W. Bousfield, Mr. W. Vibart Dixon, with Mr. A. E. Cooper, Board of Education, South Kensington, as Secretary, to consider the best means for coordinating the technological work of the Board of Education with that at present carried on by other educational organizations.

A cable despatch from St. Petersburg reports that one hundred and fifty students, recently arrested at Kieff for engaging in political agitation, are to be expatriated to Port Arthur, where they will do military service. The same fate awaits scores of students arrested at the capital on a similar charge. The ferment continues among students throughout the country, and disturbances are anticipated. The troubles at Kieff do not seem to have been due to political agitation but to the unwillingness of the students to attend the lectures of an unpopular professor.

Mr. H. V. Carpenter, assistant in physics at the University of Illinois, has accepted an assistant professorship in physics and electrical engineering in the Washington Agricultural College, at Pullman, Washington. Mr. Carpenter is a graduate of the University of Illinois.

Mr. U. S. Hanna, Harrison fellow in mathematics and astronomy of the University of Pennsylvania, has resigned his fellowship to resume his duties as instructor in mathematics at the University of Indiana.

Mr. S. W. Reaves, graduate scholar in Cornell university, has been appointed instructor of mathematics in Orchard Lake Military Academy.

Dr. F. Monteser has been promoted to a professorship of mathematics in the School of Pedagogy, New York University.

Mr. C. T. R. Wilson, F.R.S., fellow of Sidney Sussex College, Cambridge, has been appointed university lecturer in experimental physics in succession to Professor Wilberforce, who, it will be remembered, recently accepted a call to Liverpool.

Dr. P. Drude, professor of physics in the University at Giessen, has been called to Tubingen. Dr. A. Voelzman, of Berlin, has been promoted to a professorship of zoology. Dr. A. Steur has qualified as docent in geology in the Technical Institute at Darmstadt, and Dr. George Wetzel for anatomy in the University at Berlin.